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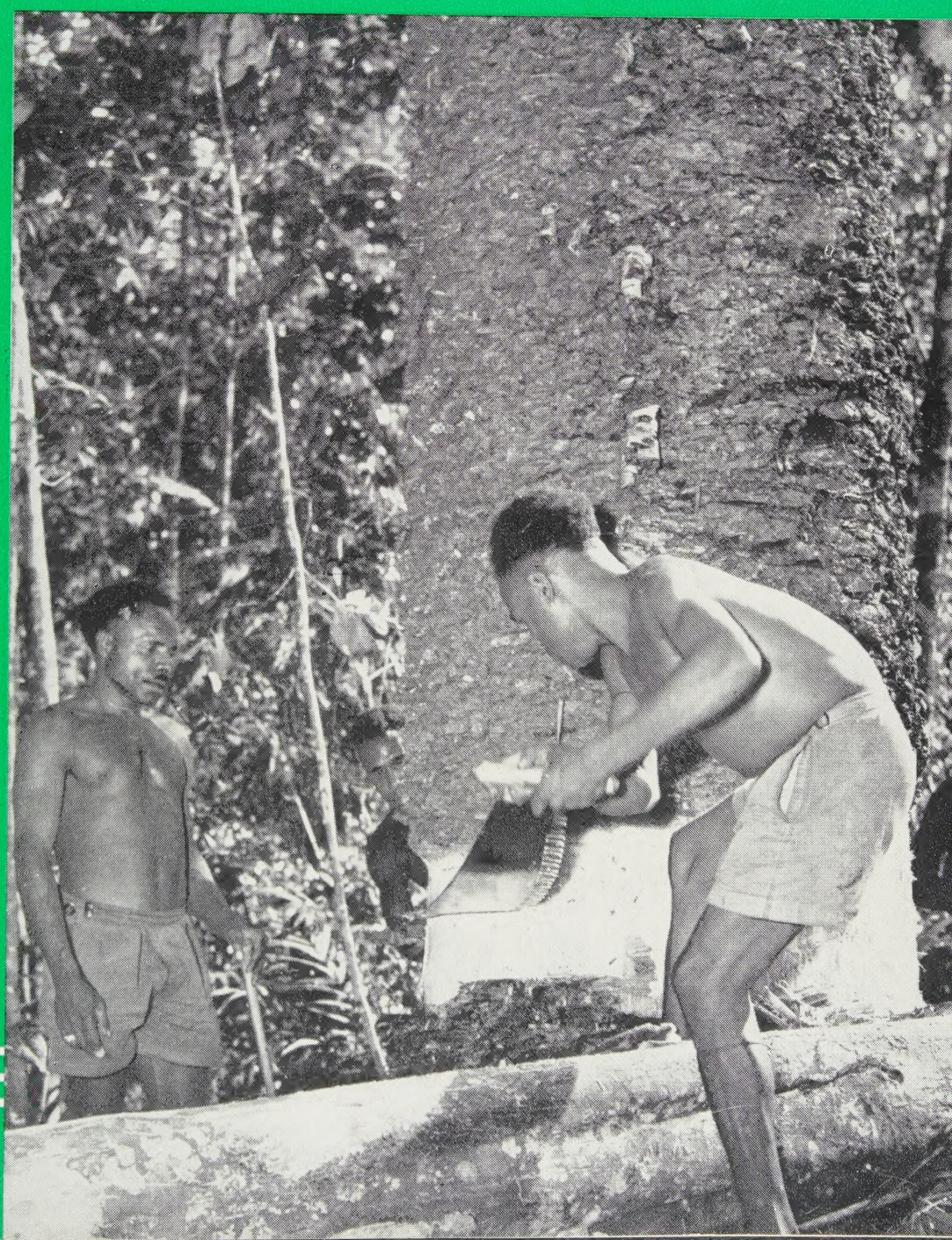
SPC SOUTH PACIFIC COMMISSION

quarterly Bulletin



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The South Pacific Commission is an advisory and consultative body set up in 1947 by the six Governments responsible for the administration of island territories in the South Pacific region (Australia, France, the Netherlands, New Zealand, the United Kingdom and the United States of America).

The Commission's purpose is to advise the participating Governments on ways of improving the well-being of the people of the Pacific island territories. It is concerned with health, economic and social matters. Its headquarters are at Nouméa, New Caledonia.

The Commission consists of not more than twelve Commissioners, two from each Government. It normally holds one Session each year. There are two auxiliary bodies, the Research Council and the South Pacific Conference.

There is a Research Council meeting once a year. This may be either a meeting of the full Council, or of one or other of its three main sections, specializing in the fields of health, economic development and social development. Members of the Research Council are appointed by the Commission. They are selected for their special knowledge of the questions with which the Commission is concerned, and the problems of the territories in these fields. The chief function of the Research Council is to advise the Commission on what investigations are necessary. Arrangements to carry out those that are approved are the responsibility of the Secretary-General and other principal officers.

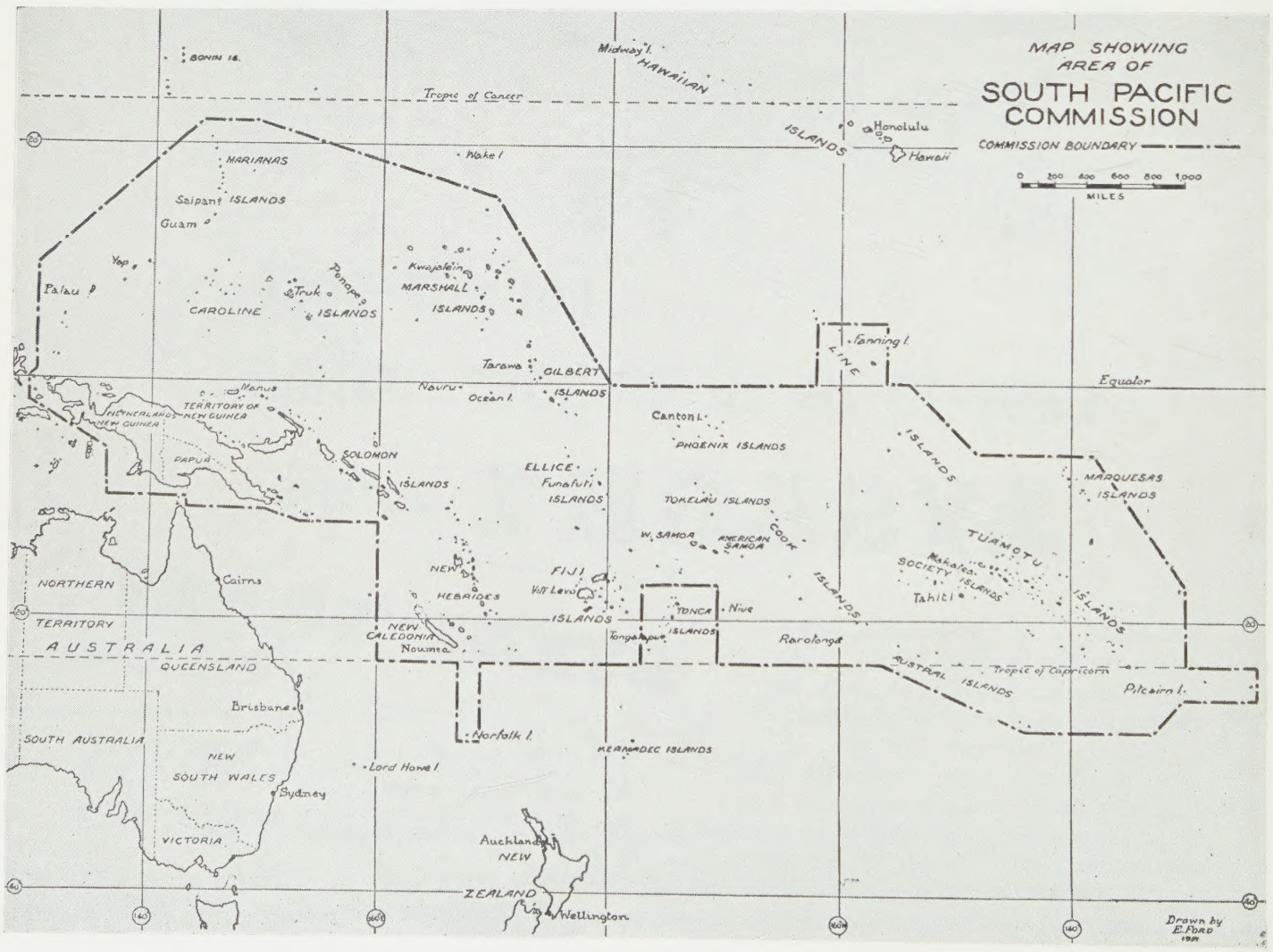
The South Pacific Conference, which meets at intervals not exceeding three years, consists of delegates from the local inhabitants of the territories, who may be accompanied by advisers. The first Conference was held in Fiji in April 1950, and was attended by delegates from fifteen territories and from the Kingdom of Tonga. The second Conference was held at Commission headquarters in April 1953. The third Conference was held in Fiji in April-May 1956.

The principal officers of the Commission are: Secretary-General, Mr. T. R. Smith; Executive Officer for Health, Dr. E. Massal; Executive Officer for Economic Development, Dr. A. H. J. Kroon; Executive Officer for Social Development, Dr. Richard Seddon. The powers and functions of the Deputy Chairman, Research Council, are exercised by the Secretary-General.

Further particulars of the Commission's activities may be obtained from the Secretary-General, Nouméa, New Caledonia.

FRONT COVER PHOTOGRAPH

New Guinea timber-getters felling a 185-foot Bulolo pine on a timber lease in the Wau District. The post-war growth of the timber industry in Papua and New Guinea has been spectacular, the annual log cut having quadrupled since 1948. A programme for future forestry development in the territory was recently approved. It provides for a considerable expansion in forest survey work, and in re-forestation, while a school will be established at Bulolo for training natives in survey, silvicultural and marketing control work.



SPC QUARTERLY BULLETIN

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THE SPC QUARTERLY BULLETIN, first published in January, 1951, features articles on selected activities in the Commission's three main fields of operation: economic development, health and social development. Articles are also contributed by specialists working in these and related fields, in the territories within the Commission area.

THE BULLETIN is given selective world distribution to people and institutions in widely differing fields sharing a common interest in the purposes and work of the Commission. It is published in two editions, English and French.

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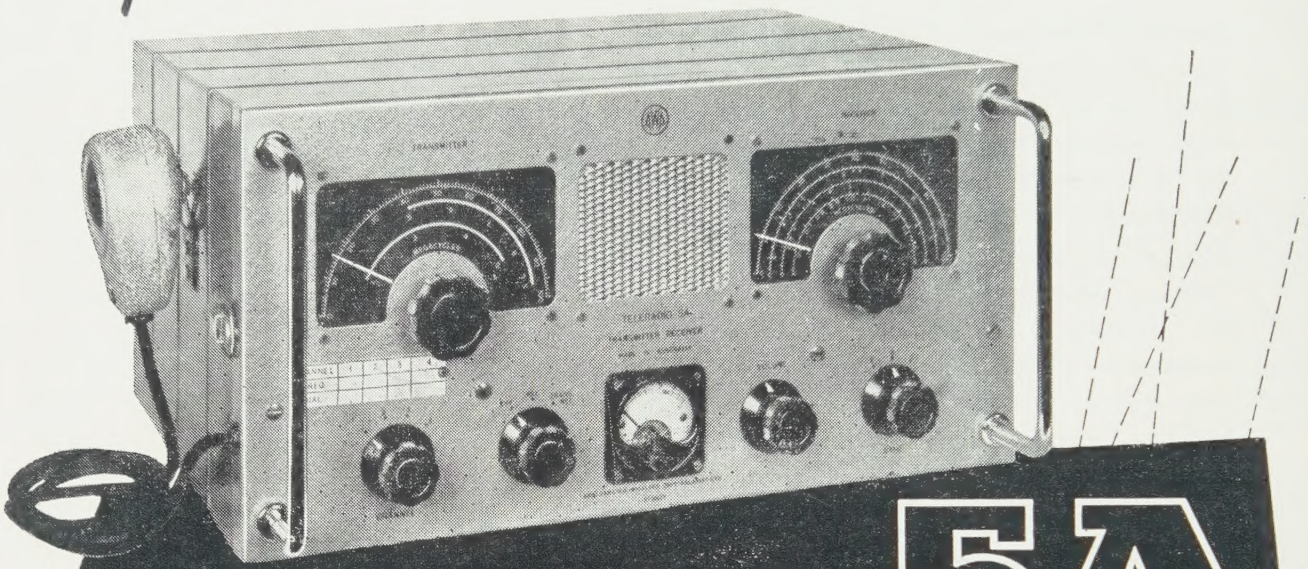

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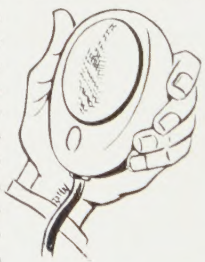

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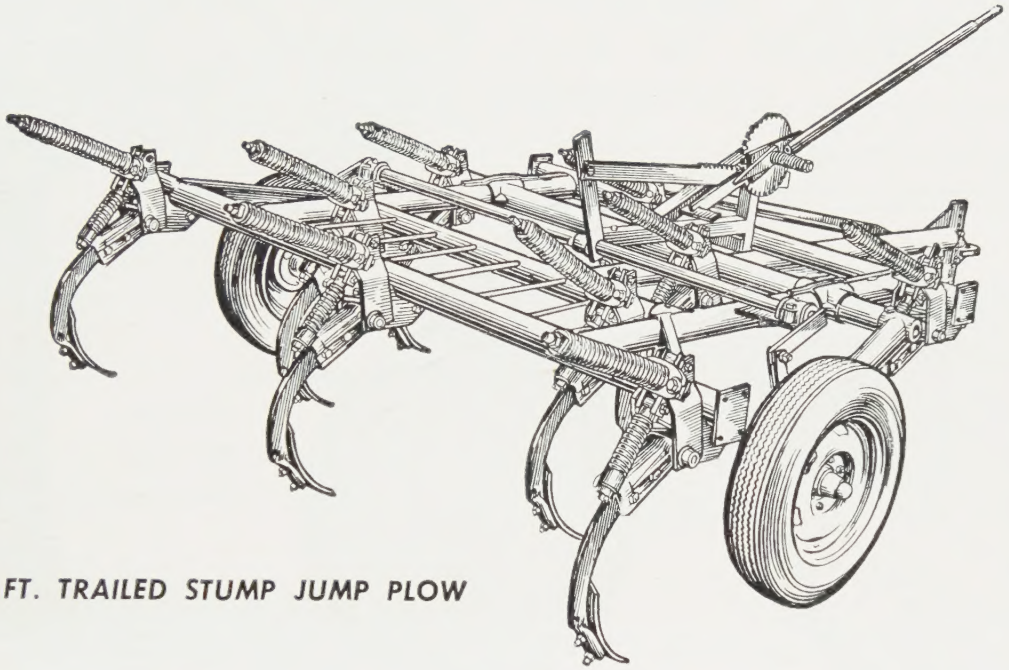

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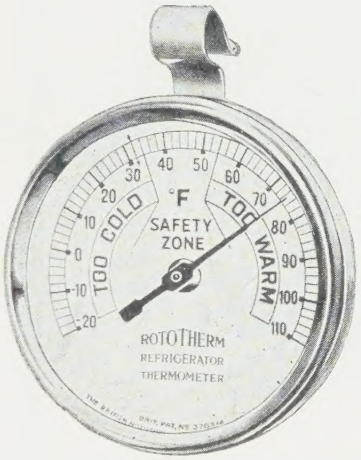

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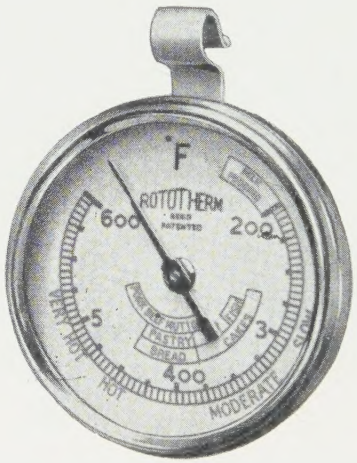

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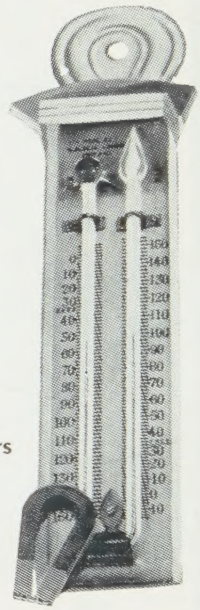

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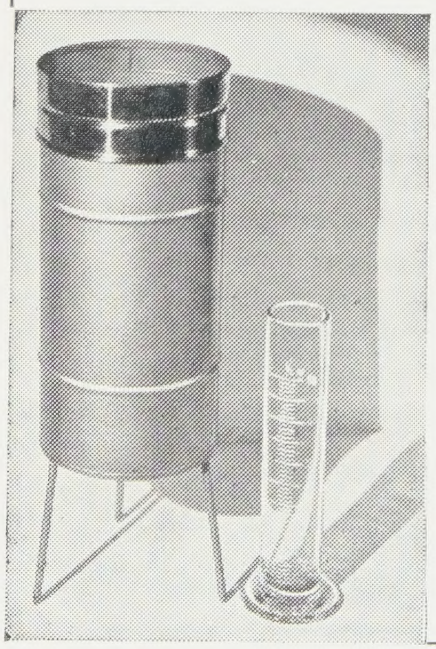

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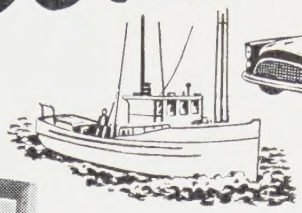

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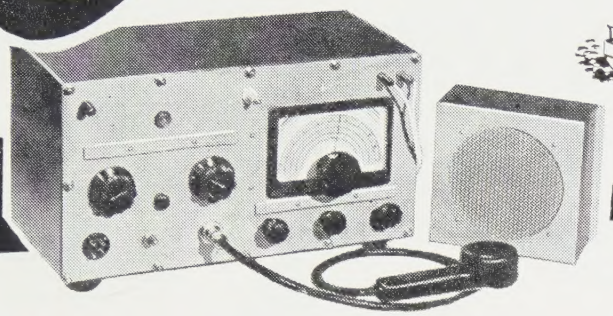

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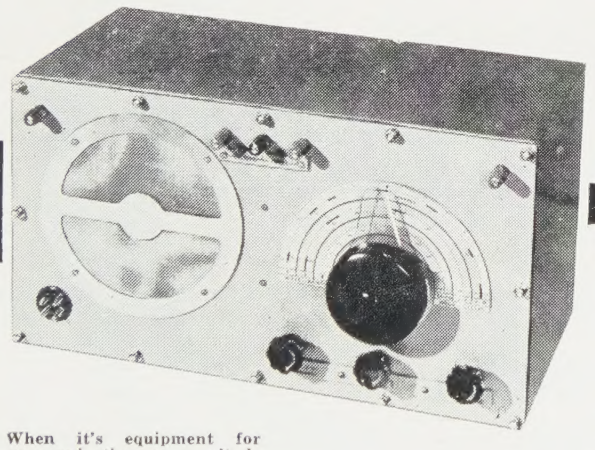

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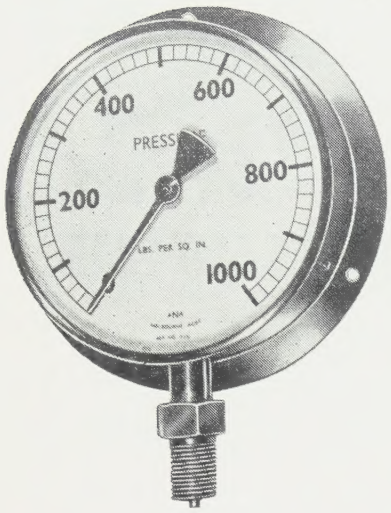

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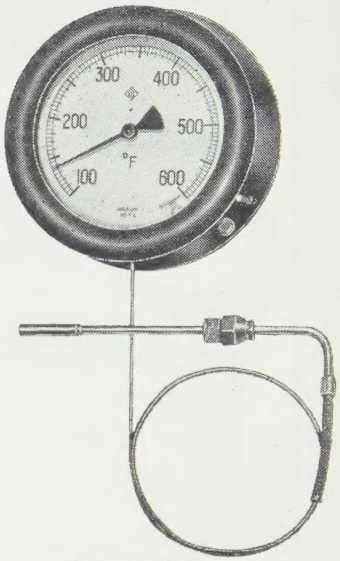

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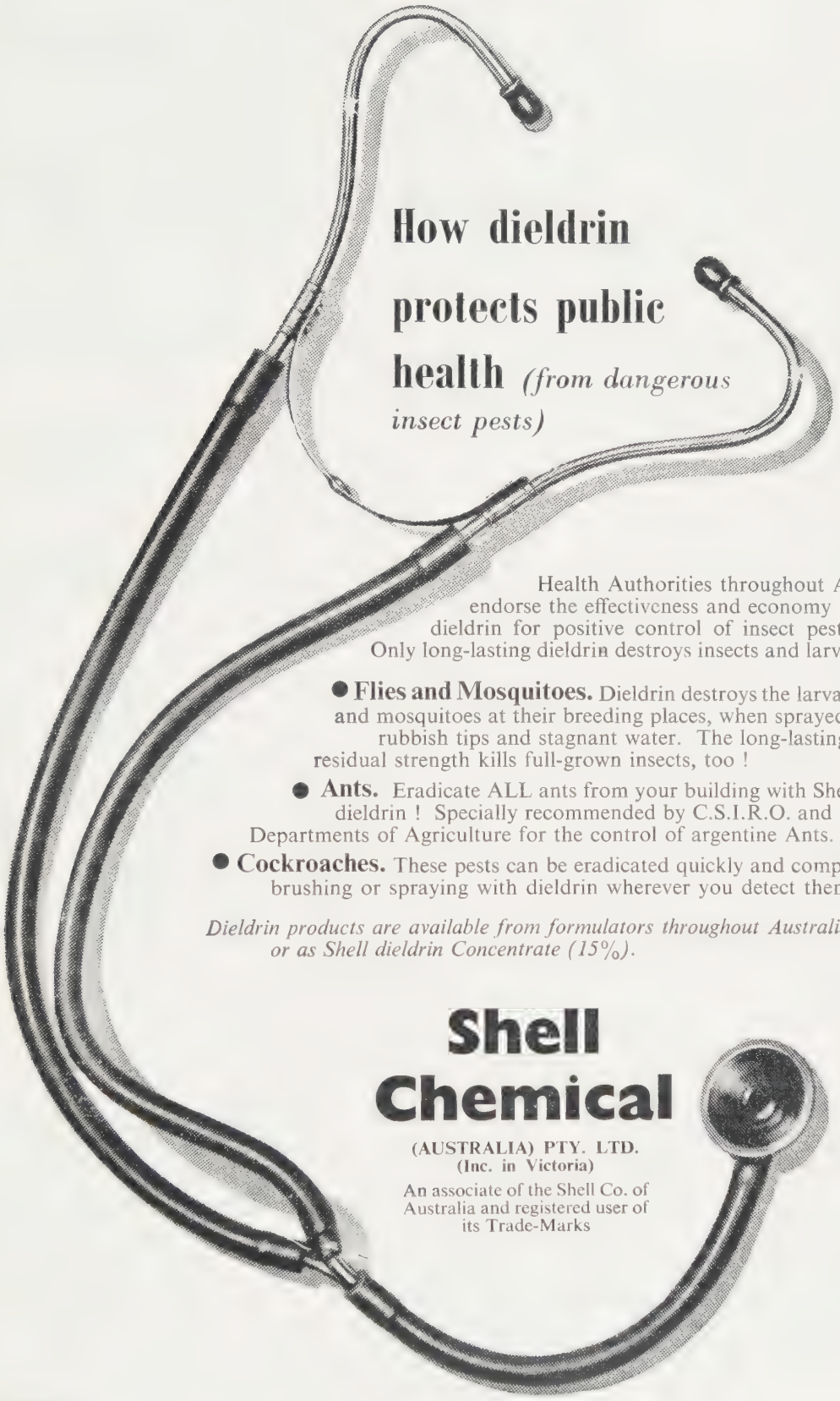

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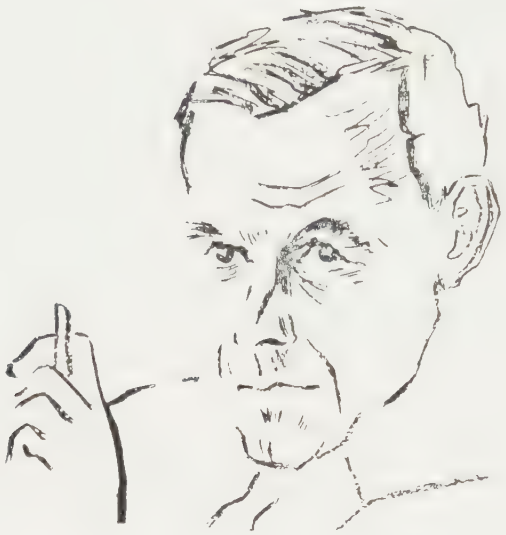

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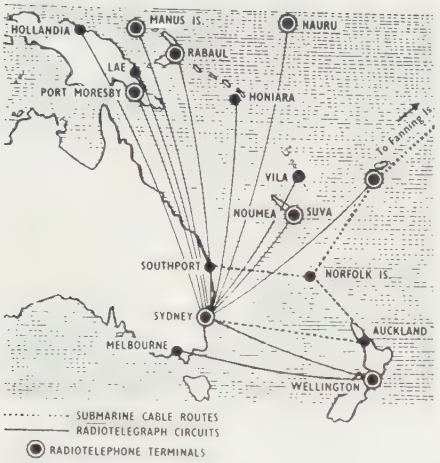

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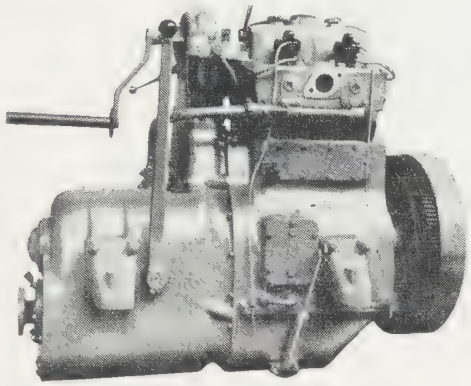

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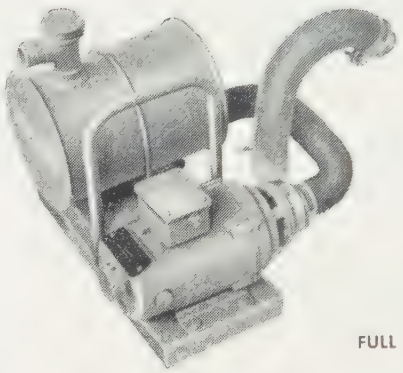

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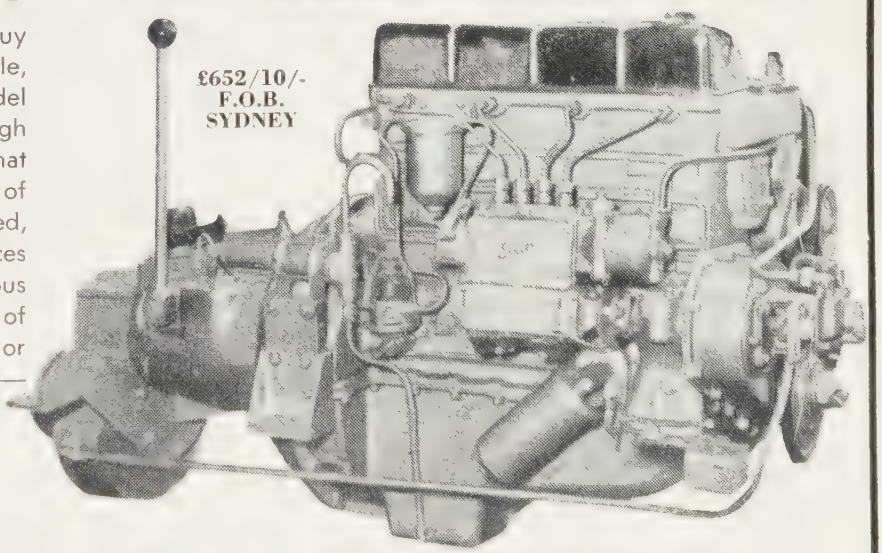

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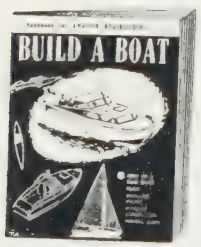

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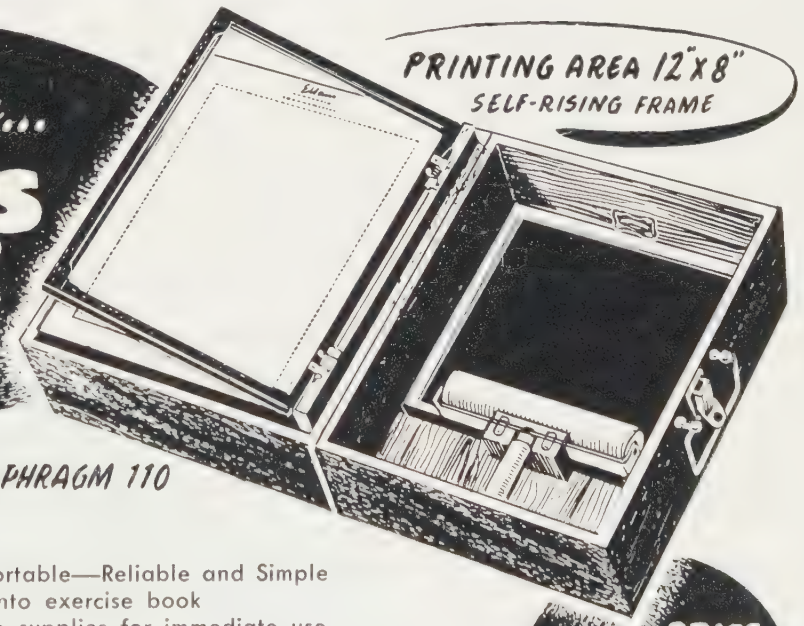

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Training Papuans As Boat-Builders

From 1930 to 1939 the author directed for a mission station on Kwato Island, a Government-subsidized school for training Papuans as boat-builders. The scheme was highly successful. A wide variety of craft from 10 to 65 feet in length were built or repaired by the trainees, whose natural aptitude for boat-building the author found equalled that of European apprentices.

By ARTHUR SWINFIELD*

At Kwato Mission in 1932. Technical school is on the right, boatshed centre. The timber mill (left) cut and dressed boat-building timber almost to order.

THROUGH the centuries the Polynesian and Melanesian peoples have thoroughly demonstrated their natural ability to build and operate sailing canoes all over the Pacific. This is well appreciated by most, especially those commercially interested in boat-building. However, it is *not* generally well known that many of these people have also demonstrated their ability to grasp the rather complex trade or art of building small boats as practised by European builders. This is undoubtedly due to their own natural aptitude for handcrafts, around which they have built their own way of life, adapted to Pacific conditions.

The author recalls many interesting discussions held with old Papuan canoe builders, and through these learned to appreciate the ability and craftsmanship of these very fine men. Their appreciation of line and form as displayed in a 40-foot dugout canoe was perfection itself, and when sail area was discussed the Mailu canoes with their crab-claw shaped sails always came into the picture.

A very good example of what, in many of these people, lies "just below the surface" (if one may be allowed to use such a term) was given early in the 1930's, when a well-known mission station situated on Kwato Island decided to enlarge its small boatshed and accept an offer by the Papuan Government to subsidize a technical school specialising in boat-building.

Sir Hubert Murray and the Rev. Charles Abel were both keen to see this training scheme under way, and it was the author's privilege to launch and direct it over a period of nine years.

Earlier attempts had been made to teach boat-building to Papuans, but a full sense of responsibility was somehow withheld from trainees, mainly because it was perhaps felt that they were not ready or willing to accept responsibility.

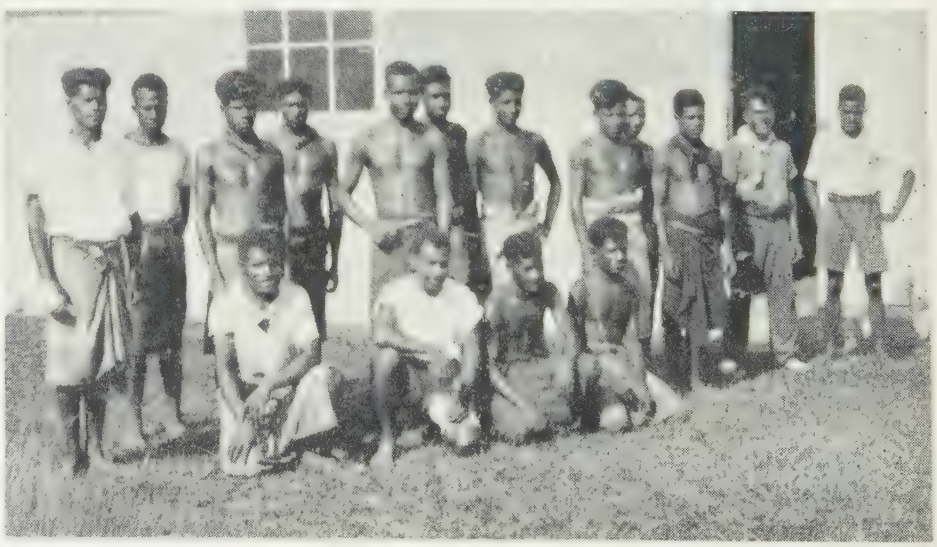
This was not really so. Mainly, the fault lay perhaps in the way tuition and criticism were given, for, in actual fact, provided the new recruit to boat-building is keen and reasonably intelligent, he quickly overcomes his shyness and settles down to assimilate all that his teacher can teach, and that which his background permits him to understand.

Many of the trainees recruited for the training scheme had had the benefit of a mission school training, though quite a few were ordinary village folk. However, equipped with the most important assets of all, enthusiasm and determination, they soon settled down to learn this way of "real" boat-building.

The annual enrolment of trainees was twenty—and the average length of the course was three years.

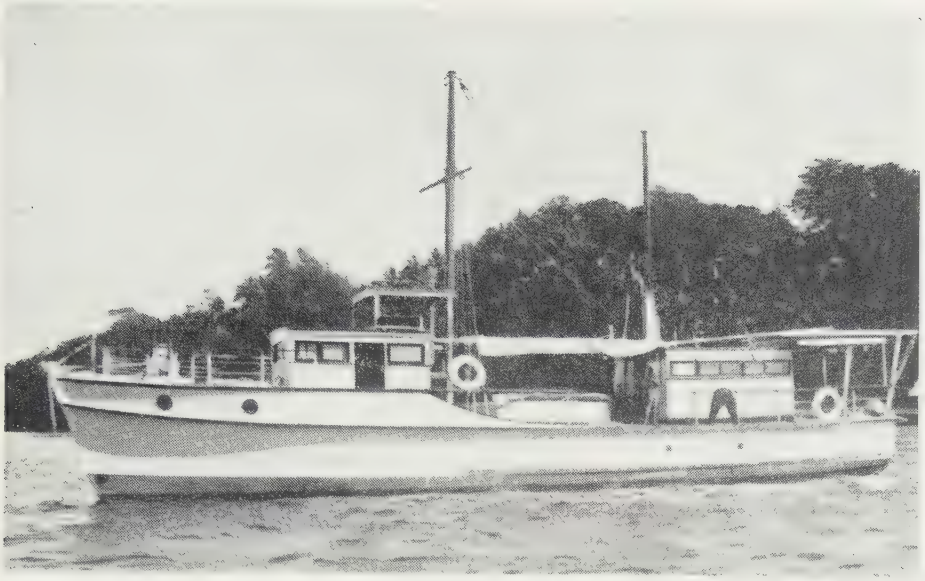
A great advantage enjoyed by the scheme was the excellent timber mill nearby, which cut and dressed boat-building timber almost to order. It was run by native mill-hands, many of whom became trainee boat-builders.

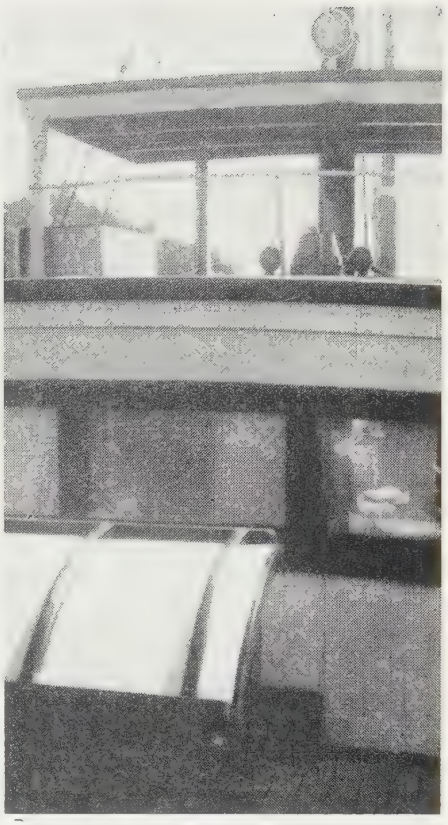
In accordance with a technical school



A typical group of Kwato boat-building trainees, who built many fine craft.

* Mr. Swinfield is an Australian naval architect. His services were made available by the Food and Agriculture Organization as a lecturer on boat building and marine engines at the Fisheries Training Course held at Commission headquarters under SPC-FAO auspices from 19 November 1956 to 21 February 1957.





Above: "Kwato II", designed by the author and built by Papuan trainees under his direction, is 62' on the waterline. She was launched in 1934 and saw service throughout World War II. Now known as "Moutuana", she is owned by a Milne Bay co-operative society. Right: Fine craftsmanship is apparent in this close-up of deck joinery work on "Kwato II".

programme laid down on broad lines by the Papuan Government, 16 to 20 students began their preliminary wood-working training in 1930 at a small school situated about 100 yards from the boat-building sheds and timber mill. This training included very elementary geometry (as used in simple boat-building), use of wood-working tools, elementary drawing, and a knowledge of dimensioned rough sketches.

Needless to say, these early students were "hand-picked", and all spoke fairly good English.

They came from villages all along the coast, and "lived in" on the mission station while serving their training period. Hours were not long and the work was kept as interesting as possible. All types of sport were encouraged, for this greatly helped to overcome the initial shyness of the trainee and allowed him to demonstrate his ability to "give and take" away from work-a-day life.

Technical school lessons were given twice a week, each lesson lasting two hours. Monthly tests were given to ascertain progress. At the same time, in the boatsheds the trainees were receiving continual instruction in practical boat-building.

Teaching was not easy, although most interesting. It can be truly said that the apt Papuan trainee could hold his own with any ordinary European apprentice in wood working, and in many cases would perhaps generally excel in boat-building.

Theory was not so easily understood, but, all in all, a good journeyman (one who had completed his apprenticeship) could be turned out in three years, as compared with the usual European period of five years.

This can be readily understood when one considers the fact that these trainees were most keen to learn, and had none of the side issues to distract them that the average apprentice in an Australian boat-building yard has.

Most Satisfactory Results

Results were most satisfactory, and before long the "school" was in production. Whaleboats, dinghies, cutters, and launches of all types were built and repaired. Those built ranged from 10 to 65 feet in length, and those repaired were some of the largest in the territory. Some of the more interesting vessels built by Kwato were:

Six 32-foot trochus cutters and eighteen trochus fishing dinghies (all to one order).

Kwato I, a 40-foot (LWL) mission vessel, later sold to a North East Coast trader.

Osiri, a larger edition of *Kwato I*. She achieved fame in the earliest stages of the Japanese landings at Ahioma and Giligili in Milne Bay.

Kwato II, a 60-foot (LWL), twin-screw diesel vessel which, to the author's knowledge, is still the largest vessel of her type to be built by native labour in the Pacific. She would be a credit to any European boatyard. She was launched about 1937 by Sir Hubert Murray, and during the whole of World War II was in commission by the Armed Services. She is now owned by a large Co-operative Society in Papua.

Over the years the "school" achieved a very enviable reputation, and pupils came from far and near to learn boat-building or an allied trade.

In time, the scheme became practically self-supporting, and from very humble beginnings became famous throughout Papua and New Guinea for the quality of its work in building and repairing boats.

Unfortunately World War II interfered with the progress of the "school", and it is now many years since a technical training scheme flourished as it did in the days when *Kwato II* was being built. Nevertheless, the need for such a centre still exists.

Such is the story in brief of one technical training scheme that really worked. Not only did it produce good tradesmen: it also produced men with confidence in themselves and with a much broader outlook on life.

Although the greater proportion of trainees followed boat-building after the completion of their training period, many chose house-building, but no matter what "trade" they adopted—their services were always in great demand throughout Papua.

Factors Essential For Success

The success of the Kwato training scheme could perhaps be attributed to several factors, including—

Careful selection of trainees;
healthy location of school;
access to timber stocks;
reasonable provision of machinery;
encouragement given to the earliest trainees to assist in teaching the late-comers.

Above: Logs from trees felled locally were rolled by trainees from the beach to the mill for sawing into boat-building timber.

Left: "Neula", a launch built by trainees early in the scheme's operation.

Below: A 32-foot trochus cutter, before and after launching. Six of these craft, and eighteen trochus fishing dinghies, were built to a single order.

SELECTION OF TRAINEES: The careful selection of trainees was, of course, essential to the success of the scheme. Mission education was highly desirable, but not altogether indispensable. Many "village boys", selected for their common sense and keenness to learn, made good as boat-builders. An aptitude for the use of ordinary wood-working tools was always sought by the instructor.

LOCATION OF SCHOOL: The school was located on a very healthy island, practically free from malaria, and about two miles from a good shipping port. Malaria soon "deadens" interest even in the most keen student. Ordinary tropic conditions are not conducive to study, but once malaria "takes over" the student is useless. (This, of course, also applies to the instructor.)

ACCESS TO TIMBER STOCKS: Ready access to timber stocks was essential for, once material becomes scarce, the work slows down and trainees begin to lose interest. The whole success of such a scheme rests on the continuing interest shown by the instructor and the trainees.

PROVISION OF MACHINERY: The use of machinery was always a source of argument among the people interested in the training scheme. The main point at issue was: should a trainee be encouraged to use machinery or hand tools?

In the author's opinion, both are essential. One should start off with elementary hand tools, then, while these are being mastered, simple machines should be used that save time *in labour* and give the trainee more time to participate in the actual construction of a boat. It was found that continual use of hand tools tended to blunt the interest of trainees. With the aid of simple machines, however, they can actually see the results of their work materialize, the boat growing to shape before their eyes.

The use and proper care of hand tools were, of course, always encouraged, and it was not long before trainees grew to value keen-edged hand tools as well as the machines.

TRAINEES ENCOURAGED TO TEACH: Every trainee was regarded as a potential teacher of boat-building, and he was encouraged to pass his knowledge along to his "mate" at every opportunity. Generally speaking, selfishness was unknown, for in the general scheme of learning every man depended on his "mate" or

"mates" to produce a worth-while job of work.

Occasionally one would come across a true individualist, and he would be the ideal man to specialize in one or two departments of boat-building. One such trainee, the author recalls, specialized in spar-making, another in caulking, and so on. When a specialist *did* develop, he was usually a first-class man in his field.

Trainees Always Appreciative

One sometimes hears the remark that, among Pacific islanders, a sense of gratitude for a teacher's efforts is noticeable by its absence. After many years of technical teaching among Papuans and some periods of lecturing in various island groups, the author cannot in any way subscribe to this view. He has always found pupils eager to learn, and most humble and apologetic for mistakes made on the job. And never were politeness and gratitude ever lacking.

Pacific School Of Boat-Building Needed

In conclusion, the author feels that at Kwato and elsewhere the Pacific Island people have amply demonstrated their ability to learn the art of building wooden boats. The need for wooden vessels throughout the Pacific is still as great as ever, and selected students under proper tuition would reflect every credit on those responsible for the establishment of a "school" for boat-building.

The selected students or trainees would be better regarded as potential teachers, for they could then be encouraged to spread their knowledge in their own districts. All this would take considerable time, but the general benefit to the Pacific Island people would be enormous.

New Secretary-General Assumes Duties At SPC Headquarters

MR. T. R. Smith, the new Secretary-General of the South Pacific Commission, arrived in New Caledonia by air on March 7. He was met at Tontouta airport by Dr. Emile Massal, Acting Secretary-General, and representatives of the New Caledonian Government.

On his way to New Caledonia Mr. Smith visited the Commission's offices in Sydney. He spent two days in Canberra, A.C.T., where he conferred with Australian officials and representatives of other member governments of the South Pacific Commission.

New Introduction Of Edible Pond Fish From Philippines

The introduction of carefully-selected species of edible pond fish to Pacific territories for stocking inland waters forms an important part of the Commission's long-term programme for the development of fisheries in the region. In October 1955 the Commission imported by air from the Philippines an experimental consignment of tilapia. They quickly multiplied, and successful transplantings have since been made to many Pacific territories. Last January a second similar transfer of fingerlings took place, of four further species of edible pond fish. A brief account of the operation appears below.

Mr. H. van Pel, South Pacific Commission fisheries officer, holding a carp from the experimental consignment of fingerlings he brought by air with him from Manila to New Caledonia last January.

AROUND three hundred fingerlings of four different species of edible pond fish arrived in New Caledonia by air on Saturday, January 18. They had been flown over five thousand miles from the Philippines in the care of South Pacific Commission fisheries officer H. van Pel.

They have been released temporarily in two experimental fish ponds maintained for the Commission at the Port Laguerre farm school near Nouméa. Later this year they will be transferred to fish ponds being prepared by the Forestry Department of New Caledonia.

During their long journey the fingerlings were carried in plastic bags of water supported in cardboard cartons. To avoid subjecting them to extremes of cold and air pressure, Mr. van Pel kept them with him in the pressurized cabin of the airliner.

The four species in the consignment were carp, sepat, dalag and gourami. All are popular eating fish in South Asian countries, where they are widely grown in rice padi, artificial ponds or natural waters.

Over the next two years Mr. van Pel will study their rate of growth, breeding rate and general suitability for introduction to other South Pacific territories. Species which adapt themselves successfully will be transplanted to other Pacific islands, where they will provide a new source of protein for islanders not now receiving sufficient in their diets. The stocking of natural waters is the primary aim for which these fish were introduced.

An earlier introduction of another popular edible pond fish in South Asian countries—the tilapia—has proved highly successful. In October 1955 Mr. van Pel transported a consignment of tilapia fingerlings from Manila to New Caledonia by air. They quickly multiplied, and successful transplantings were made to other territories. Including several introductions made from other sources, tilapia are now being grown for food in specially-made ponds and natural waters in New Caledonia, New Hebrides, Solomon Islands, Fiji, Papua and New Guinea, Netherlands New Guinea, Cook Islands, Western Samoa, American Samoa, French Polynesia, Guam, and the United States Trust Territory.

Bamboos For The Pacific Islands (1)

Bambusa tulda Roxb. Experimental plot for comparison of harvesting methods (interval and rate of cutting). Federal Experiment Station, Mayaguez, Puerto Rico. March 1949.

Bamboo is an essential material in the human economy of many Asian countries, where it has hundreds of domestic and agricultural uses. Its similar potentialities for the South Pacific will be the subject of a study to be made early next year by the South Pacific Commission in co-operation with the Maria Moors Cabot Foundation of the United States. Dr. F. A. McClure, consultant in tropical forestry to the Foundation and a leading world authority on bamboo, will carry out a three-months' botanical survey and ecological study of this plant in the South Pacific. In the article below, Dr. McClure gives useful general information on the cultivation of bamboo, and discusses practical procedures for its propagation.

By F. A. McCLURE*

THE South Pacific Commission has proposed a survey of the potentialities of bamboo in the local economy of the areas under its jurisdiction. As a first step in carrying out this proposal the introduction of living plants of eleven superior bamboos selected for local trial is being undertaken. Plants of these species (being supplied by the United States Department of Agriculture) will be established in cultivation in Fiji, Samoa and New Caledonia. When they have developed sufficiently, material from them will be propagated in quantity for field trials in selected areas.

The diversity manifested by bamboos in respect to physical and silvicultural characteristics is a fact of great importance to the potential user. Just as one wood, or a few kinds, may prove best for one purpose, under one set of conditions, and another best for another purpose and set of conditions, so with bamboos. Each of the bamboos recommended for inclusion in the Commission's programme was selected for properties that render it outstanding among the more than 300 native and exotic species available in the Western Hemisphere in respect to one or more needs of farm, home or industry.

In selecting bamboos for cultivation, primary consideration should be given to the products or purposes for which they are to be grown. It is important to realize in this connexion that the different bamboo species vary widely in the thickness and physical properties of their wood, in the size, shape, internode length, branching and other characteristics of their culms, in the length and thickness of the individual fibres (for paper pulp), and in the palatability of the young shoots for food. Moreover, as between two species that are more or less equally suited to a given end, one may thrive better than the other under a given set of ecological conditions. This can be determined only by actual field trials.

From the point of view of the method by which the individual plants grow and spread, the bamboos being introduced to the South Pacific belong to the group known as *caespitose* or clump type. These bamboos grow typically in relatively compact clumps.

The rhizomes (underground stems) are short, thick and determinate, i.e., they grow for only a short distance in a horizontal direction before turning upward to form a new culm. This type of rhizome is sometimes referred to as *sympodial*.

Of exceptional growth habit in this group is *Melocanna baccifera*, whose determinate rhizomes have a long, slender, basal "neck", the growth of which in length results in a wider spacing of the culms and a more open clump habit.

Handling Bamboo Propagating Material

Unlike many woody plants (especially deciduous species in a dormant state) uprooted bamboo plants, or cuttings, suffer desiccation to a serious degree if exposed to sun and wind. Disregard of this fact is probably responsible for more of the failures or partial failures in bamboo plantings than all other causes combined.

If possible, the preparation of the site for the reception of the material should be completed in advance of its arrival. If the material is secured locally, provision should be made to protect it from unnecessary exposure to sun and wind from the moment it is cut or taken until it is placed in the ground.

If the material is received packed, it should be unpacked and inspected at once. This should be done in a place protected from sun and wind. The material should be checked carefully to ascertain the nature and amount of planting space needed to accommodate it. It should then be arranged in the order in which it is to be planted, moistened and covered with the packing material or vegetable litter (sphagnum). In the lack of these, the propagules may be plunged in sand or light soil, in a place well protected from sun and wind. An additional covering of burlap may be added to retard evaporation. The material should be kept moist by light sprinkling, and set out at the earliest opportunity.

Under most circumstances it is considered advisable to set out the material

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Above: Bambusa ventricosa McClure. Twelve-year-old plant with culms up to 55 feet tall and 2½ inches in diameter. Federal Experiment Station, Mayaguez, Puerto Rico. March 1949. Right: Close-up view of base of clump, showing branches leafless because shaded by dense foliage above.

in a nursery for a year, or at least until the plants have their root system established, and until the beginning of a rainy season.

For this first period it is suggested that the material be set out in trenches so oriented to the contour of the land as to provide for natural drainage, and so related to a source of water as to provide for irrigation, or at least for copious sprinkling, in case there should be a period of drought before the plants are established.

The planting distance in the nursery should be such as to provide adequate space for lifting a good ball of earth when the plants are moved to the permanent site. A distance of a metre between plants in rows 1.5 metres apart is considered minimal for most species if the plants are to be left in the original site for *not more* than one year.

In planting it is important to tamp the earth well about the roots and the base of each propagule. This process should be carried out as the soil is added, and should be *completed before any water is added to the soil.* The plants should be watered as often as necessary to keep the soil moist until they are well established.

Bamboos are apt to be killed or severely set back by prolonged exposure to intense sunshine or drying winds before the plants have become well established. In case the propagating material is set out in a season of clear skies and/or strong dry winds, it is important to provide shade and a wind-break.

A generous mulch of vegetable litter is considered very important. This will retard the loss of moisture from the soil by evaporation, and help keep down weeds and grass during the periods of heavy rainfall. The care with which the mulch is applied and maintained may be the deciding factor in the survival of the plants.

Any appreciable movement of the newly-set-out plant during the first formation of new roots reduces the chances of its becoming established. Provision should be made to guard against the culms being shaken or disturbed by wind or other agencies.

Immediately the planting is completed a map should be prepared, plotting the position of each species or accession number. This map should be clearly oriented to the points of the compass, and to some prominent landmark. The date of the planting, and reference to the relevant records concerning the plants (source, etc.) should be indicated on it.

There are numerous advantages to be realized by setting the plants in close array in a temporary nursery instead of putting them out directly in a plantation. In a nursery, uniform and favourable conditions may be provided for the whole population. The plants may be so located as to facilitate frequent inspection, watering and other care. In case of the death of one or more of the plants during the first year, the waste of time, labour and land is very small compared to what would have been involved if the plants had been set out in a plantation in the first place. Planting in a nursery allows additional time to select and prepare the land for the permanent planting.

Propagation

New bamboo plants may be produced by two general methods: by means of viable seeds and by vegetative fractions.

By Seeds: The "seed" of most bamboos is a dry one-seeded fruit called a caryopsis, which bears a readily-recognizable resemblance in size and shape to a grain of wheat. In a few kinds the "seed" or fruit is more or less massive and bears little or no external resemblance to that of the familiar cereal grain.

The propagation of bamboos by seeds has certain limitations. Most species flower but rarely, and flowering does not always culminate in the production of seed.

The seeds of bamboos lose their viability more or less completely within a few weeks or months unless stored under special conditions. David G. White, working at the Federal Experiment Station, Mayaguez, Puerto Rico, found that seeds of *Bambusa arundinacea*, collected in 1945 and stored in unsealed glass jars at room temperatures ranging between 70 and 90 degrees Fahrenheit, gave a germination of 46% at 160 days and 0% at 202 days. Seeds from the same lot stored in sealed glass jars containing dry calcium chloride and under the same temperature conditions, gave a germination of 80% at 160 days and 76% at 202 days.

The experiment was repeated with seeds of the same species collected in 1946. Seeds stored in unsealed glass jars at room temperatures (range not specified) gave 72% germination at 148 days and 36% at 227 days. Seeds stored under the same conditions, except that the jars were sealed, gave 0% at and after 148 days. Seeds from the same lot, stored in sealed glass jars containing dry calcium chloride, and under the same temperature conditions, gave a germina-

Gigantochloa apus (Schult.) Kurz ex Munro. Two 20-foot plants two years old from rooted branch cuttings. Federal Experiment Station, Mayaguez, Puerto Rico. March 1949.

tion of 78% at 148 days and 81% at 227 days. No data are given as to the relative humidity of the air during the storage period.

The fruits of *Melocanna baccifera* and some other species may germinate spontaneously as soon as they are mature, and even before they fall to the ground. In such cases the preliminary procedures described below become unnecessary and the young plant may be set out in the nursery at once.

In germinating bamboo seeds of the small wheat-like kinds, the familiar procedures and precautions should be observed. Any fine-grained stable medium such as sand, sifted sphagnum, or sifted sandy soil which does not tend to form a crust on drying, may be used. If possible, media (other than fresh sphagnum) should be sterilized to destroy weed seeds and fungi.

The seeds should be sown at least 2.5 to 5 cm. apart in rows 7.5 to 10 cm. apart, depending upon their size. and covered to a depth of about 0.5 cm. The medium should be kept moist, preferably by irrigation from below, or by means of a fine spray to avoid disturbing the surface of the soil. Extremes of temperature should be avoided and protection from wind provided.

The seedlings should be transferred to potting soil in suitable containers when they are a few inches high, in any case before they become overcrowded. Bamboo pots of ample size are well suited for this purpose as they give adequate depth for root development. When the plants have developed sufficiently they may with reasonable care be transported to considerable distances in such pots without special packing. For transplanting, the bamboo pot may be split in two to release the plant without disturbing the roots.

Vegetative Fractions: The procedure here is to begin with a fragment of a plant, and from it develop a whole plant. The smaller the serviceable fragment, the more economical the process in terms of propagating material, labour and space.

The size of the fragment from which a new plant may be developed depends at present upon the natural rooting propensity of the species involved. A culm cutting or even a main branch from *Gigantochloa apus* and a few others will, under favourable conditions, give rise to a new plant.

Vegetative fractions of some species of bamboo are so difficult to root that it is necessary, in the present state of our knowledge, to use clump divisions. These comprise the basal portion of one or more (adjacent) culms, together with the rhizome from which they originated, since the rhizome is the part of the plant from which the roots grow naturally.

In some bamboos the principal branch at each of the lower nodes of the culm generates roots or root primordia spontaneously on the enlarged basal portion while still in place on the culm. Such branches usually give good results as cuttings. In bamboos where the branches do not generate root primordia, results vary widely with the species and with the time of year at which the cutting is made.

Results obtained by David White at Mayaguez in Puerto Rico indicate that for most of the species tried, cuttings made during December, March and June gave better results than those made in September. Systematic trials of various methods should be carried out at each station, and when the best procedures for each species under local conditions have been determined this information should be made generally available by publication.

Meanwhile the method of propagation by *divisions of the clump* may be used with complete confidence by anyone who observes the precautions dictated by the common sense of a good plantsman. Suggestions relating to the principal points to keep in mind follow, arranged in the order of their observance.

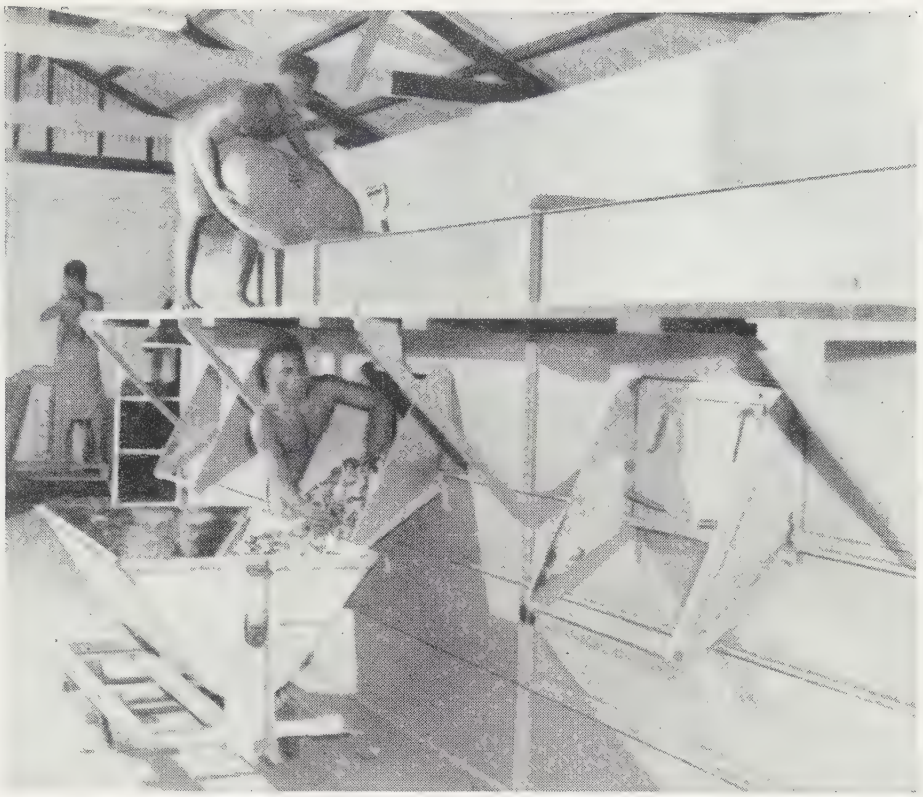
1. Prepare and set out propagating material at the beginning of the rainy season.
2. Decapitate the culms to be lifted, leaving one or two bud- or branch-bearing nodes on each one.
3. Remove the soil from around the base of each culm, cutting the roots at a distance of about 15 cm. from the rhizome, and expose the point of junction of the rhizome with the one from which it originated.
4. Sever the rhizome at the slender neck and lift the culm and its attached rhizome with a ball of earth.
5. Protect the propagule from sun and wind, and keep it in a moist condition until it can be set in its new location.
6. Set in a planting hole or trench of adequate depth and breadth and cover to the depth at which it was growing in the first place.
7. Tamp the earth well as it is added, and *water only after this process has been completed.*
8. Mulch well and water thereafter as needed to keep the soil moist until the plant is well established.
9. Keep down the weeds around the plant, with special attention to twiners, until it is large enough to fend for itself. Maintenance of a heavy mulch is recommended as the most satisfactory way to suppress weeds and conserve moisture around the base of the plant.

Cultural Requirements

These plants will be introduced into widely-separated geographical areas representing highly diverse ecological settings. Each site represents a distinct combination of inter-related environmental conditions produced by the topography of the land, the type, fertility and drain-

(Continued on page 56)

This Chula hot-air copra drier on the New Ireland coconut plantation of Mr. E. Stanfield can process two tons of copra daily.



High Quality Copra From Hot-Air Driers

This article by a leading Pacific authority on the coconut industry describes how common pitfalls of copra processing in hot-air kilns can be avoided, ensuring production of copra of uniformly high quality.

By D. R. A. EDEN

THE hot-air drier or kiln was originally adapted for copra drying from similar plant used for the dehydration of soft fruit.

Its use was first suggested, not so much to improve copra quality, but to overcome the vagaries of tropical weather. During a wet season so much loss was occasioned through parcels of partly-dried copra literally rotting on the sun-drying platforms while rain poured down for days on end, that planters decided to use artificial means for curing their product. Smoke driers and hot-air kilns were both in use before the turn of the century.

Many of the early planters interested in the production of high-quality copra rejected smoke-drying methods, and endeavoured to invent better and more economically-operated plants, capable of turning out a perfect product. Over the years successful models became legion. So numerous are their designs in fact that only the most outstanding and typical have been described in publications.

W. V. D. Pieris, in his SPC Technical Paper No. 82, *The Manufacture of Copra in the Pacific Islands,* describes and illustrates with photographs and diagrams many of the copra-drying methods used throughout the tropics. These include sun drying and smoke drying, the use of the Ceylon-type drier, the classical hot-air dehydrator and the mechanical power-driven bulk drier.

Each particular locality seems to develop a preference for a particular model or type. For instance, the smoke-drying method of curing copra is confined very largely, though not entirely, to Melanesian island groups. The Ceylon-type drier, which is sometimes described as a smoke house and sometimes as a hot-air drier, has found popularity on plantations in the Territory of Papua and New Guinea but, by comparison, its use could not be described as popular in other South Pacific groups.

On the other hand, the classical hot-air kiln is to be found in all its many forms in almost every corner of the Pacific. Within this category are to be found large plantation models capable of producing a ton and more of hot-air dried copra every twenty-four hours, while other models, adapted for the use of small-holders and native farmers, may have a daily out-turn of not more than a few hundred pounds.

Because of this tropical universality I have applied my remarks to the production of good copra through the use of the classical or common form of hot-air kiln, with banks of trays.

Whilst the experienced planter is familiar with the many do's and don't's of copra processing, the newcomer is sometimes reluctant to bother his neighbour with too many questions concerning drying procedures. The following hints are offered and may be found helpful to the beginner in avoiding the usual pitfalls of hot-air drying.

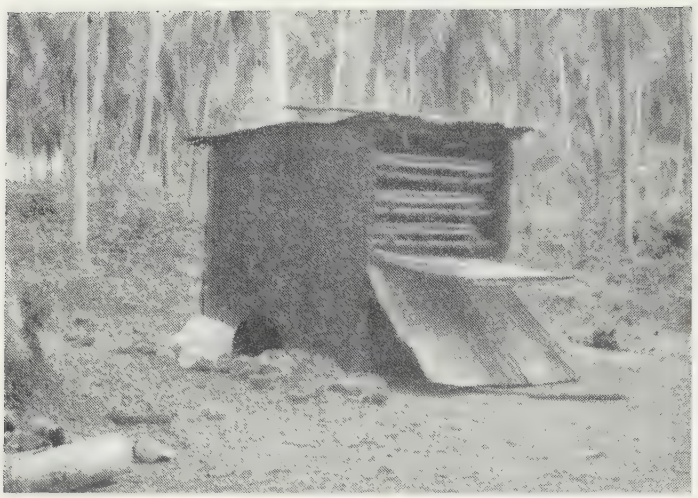
The classical drier to which I refer is the type which relies for operation upon the fact that air, when heated, rises. These structures are invariably equipped with some form of flue. The flue pipe leads from a furnace through an enclosure or heating chamber to a smoke stack. The air surrounding the flue is heated and rises through the wire mesh trays upon which copra is spread for drying.

Where dependence must necessarily be placed upon native operators with a primitive or at best a limited educational background, simple routine instructions, easily learned and followed without variation, are invaluable. The designs of the many forms of the hot-air drier are invariably simple. If their general rules of procedure are followed under normal supervision, their operation may be safely left in the hands of the average plantation labourer.

Early Drying Of Copra Important

To halt fermentation every endeavour should be made to load green copra into a drier within four hours of opening the nuts. If this cannot be done, and long delays in the field or at the drier are unavoidable, the green copra should be washed before it is placed in the drier.

Commencing the drying process with good, clean, fresh copra is all-important. If the kernels have fermented it is impossible to turn them into high-grade dry



Japanese modification of German hot-air drier for use of small-holders in the Caroline and Marshall Islands.

copra. Fermented material may contain a high percentage of free fatty acid and it may become rancid, while appearance after drying is inevitably spoilt by being singed brown.

These undesirable qualities may be the result of two causes, both having very similar effects.

The first is (as already stated) the use of fermented material, brought about by allowing cut copra to lie around, exposed to the air, for over four hours before being placed in the drier. In this case the organism which causes fermentation feeds on the natural sugar content of the coconut kernel, breaking down cell tissue and liberating a thin film of free oil on the surface. Bio-chemical changes then tend to increase the formation of free fatty acids, while the surface slime (detectable by hand an hour or so after cutting) resists dehydration. Unless washed off, this unhealthy surface singes brown at normal drier temperatures.

The second is the use of a large proportion of germinated nuts in a batch of copra. Here, according to Pieris, ill-effects from these growing nuts are "due to the destructive action of enzymes secreted by the absorbent organ of the developing seedling which liberates free oil. This, in contact with moisture and air after the nut is split, is liable to be broken down into f.f.a. and glycerine. There is also an accelerated development of rancidity."

The remedy in this case is the segregation and the separate opening of all growing nuts. They can then be washed in fresh water before drying.

Correct Drier Temperatures Important

The drier should be well heated before the first batch of copra goes in. Thereafter, at any time green copra is being loaded, the fire should be built up, and the temperature maintained between 150 and 160 degrees Fahrenheit.

The entire drier should be hot when the green meat is being put in. Warming up a cold drier, laden with trays of wet copra, involves hours of heavy firing. This slow heating, too, will take the freshly-cut copra through a long, dangerous stage when the warm, humid conditions become favourable to the germination of fungus. Spores of the yellow and black moulds thrive on wet copra at moderate temperature levels, inside or outside a drier.

When the plant is hot, surface moisture is rapidly lost from the green meat, and this eliminates fermentation and reduces the chance of mould formation. It is also the correct early step for gaining top-quality copra. If this initial step is wrongly handled, the product's appearance cannot be restored in the later drying stages.

It is advisable to keep a plainly-marked Fahrenheit thermometer in each drier. Correct temperatures are important, not only in the high initial stages of around 160 degrees when the copra is fresh and wet, but also at the lower general operating levels between 110 and 120 degrees, required after surface moisture has been eliminated.

While there is some latitude for the fluctuations of temperature in any well-constructed drier, entire reliance upon guesswork as to temperature encourages quality variations.

Rapid Removal Of Surface Moisture Desirable

In order to gain maximum heat for the quick removal of surface moisture, each tray of wet copra should be given two hours in the lowest, or second lowest, lines in the drying chamber at full initial heat (160 degrees). These are the hottest rows in a drier with many lines of trays.

When, by hand test, the surface of the copra is dry, those trays in the lower lines should be moved to higher lines to make room for further arrivals of wet copra.

Initial or loading heat should not be reduced until the whole day's cut has had its full two hours in the lowest lines, or until the operator is satisfied that surface moisture has been removed from the whole batch.

The novice with a tray drier need not be alarmed that the steam-like moisture which rises from the wet copra as it dries on the first two lines will adversely affect any partly-dried copra above. On the contrary, it prevents the copra in the upper trays, already partly dry, from being singed by the high initial temperatures necessary for the fresh wet product below.

Providing that the moisture-laden air from the bottom trays has a clear exit through the roof structure of the drier, its passage through the partly-dried copra on the upper tray lines will continue their drying process quite satisfactorily. At this stage the rising hot air, though moist, is not saturated, and no precipitation can take place until it has passed out of the drier into the colder temperatures outside.

Avoid Overheating

Many failures to produce good copra are the direct result of overheating. This often happens at night. The night-shift operator stacks up a roaring fire in the furnace in the small hours of the morning in the hope that it will last until daylight and so allow him to have an undisturbed night's sleep.

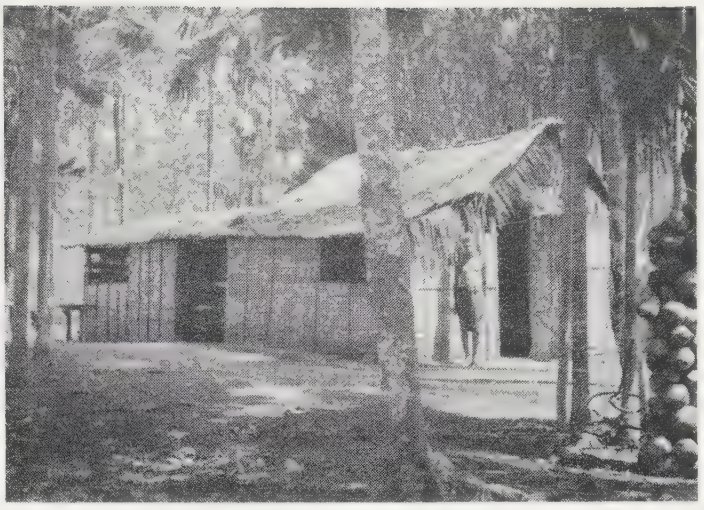
Partly-dried copra is quickly burned brown at temperatures above 120 degrees. Excessive heat, even for half an hour's duration, will spoil a batch in this way. Protection against unreliable night-shift operators is of course the time-recording clock which must be punched at regular intervals during the night.

Some operators are inclined to use too much heat in an effort to reduce drying time. This can only be successful at the cost of quality; appearance is sacrificed and oil content suffers.

Overloading Can Spoil Good Copra

Another cause of failure is overloading. There always appears to be a little more room where another bag or two of green can be stowed.

Very often this is the result of misjudgment in cutting. A planter is always familiar with the maximum quantity of copra his drier will hold. Arrangements are made to cut just that amount, but for some reason a surplus arrives at the drier. Unwilling to sacrifice this, the planter then overloads to protect the copra surplus from being dumped. The result is inevitably poor, unevenly-dried copra—some under-dried, some singed and brown. Case hardened and rancid under-dried copra are both to be found in an overloaded drier.



Above: Ceylon-type hot-air drier in Honiara, British Solomon Islands, built as a demonstration model by the Department of Agriculture. Right: Native hot-air drier in New Ireland capable of producing copra in "cups" of the highest quality. Common method of nut storage shown on right.

A drier's capacity is only so much. Trays are usually designed to hold no more green than can be spread upon them to an average depth of four inches.

When normal quantities are exceeded the proper movement of the rising hot air is interfered with. Cold pockets of stagnant air become locked within the heaps of cut copra, and serious unevenness of drying is the result.

There is very little to be done about an overloaded drier except to ensure that the following day's cut is severely restricted to give the plant time to clear itself of undried copra. Normal temperatures must never be exceeded. Frequent movement of the material in the drier helps to free cold pocket locks, and to expose pieces which have become stuck together and cut off from the heat supply in the overloaded mass.

To guard against the contingency of spoiling surplus green copra, a planter would be well advised to have empty cement or iron tanks or petrol drums handy, in fact anything that will hold fairly large volumes of water. Then in the event of over-cutting, instead of being forced to overload the drier, any surplus can be emptied into the tanks, and held under water until the next day without fear of it deteriorating. Copra can be safely held under water for some days before being dried out into perfectly good copra.

Underloading

No possible harm—except the certainty of higher drying costs—can accrue from an underloaded drier if normal routine is followed.

Sometimes a small quantity of copra has to be dried at the end of a collecting round. The volume of green copra may not be sufficient to fill every tray in the bottom lines, or the whole deck in the case of a platform drier. In this event the planter should take steps to fill the empty spaces with old sheets of roofing iron or other suitable non-inflammable material to act as blanketing.

Open spaces act as rapid exits for the hot air to escape through. Unless closed, such exits keep the drier cold despite constant stoking of the furnace.

Changing Tray Positions Ensures Even Drying

When surface moisture has been disposed of, drier temperatures are lowered to a point where the maximum average is 120 degrees.

At this point, and thereafter at regular six-hourly intervals, all the trays should be reversed in their positions, the top lines to the bottom and vice versa. The bottom lines are always hottest, and the changes will ensure evenness of drying for the whole batch.

When the trays are taken out to be changed, they should be conveniently supported on a stand, and their contents disturbed by hand and shaken about. This will get rid of copra dust, and the hand movements among the cut pieces will separate any that may have stuck together, thereby exposing any concealed surfaces to the hot air.

Dry Copra Should Be Removed Immediately

When the planter is satisfied that the copra is dry it should be taken out of the drier. If left too long it will burn brown. When dry, it should break with a crisp snap; it should be steely grey or pearly white in colour, and without a bone line. The bone is an unmistakable and variable line of white to be found near the centre of the break. It denotes the presence of moisture, and pieces showing this are not fully dry. Such copra should be returned to the drier for a further period.

Cool Before Bagging

After the fully-dried copra has been removed from the drier it should be heaped on the floor and allowed to cool before being bagged. If bagged hot it will sweat; it becomes flaccid and rubbery and is liable to mould.

Use Of Cold Air Vents

Cold air vents in the walls of the drier below the flue pipes should be closed with baffles only on the side of a prevailing wind, and then only when a breeze is blowing. It is otherwise quite unnecessary to close the cold air intakes.

Rising hot air will draw through the cold vents only sufficient outside air to replace its own volume.

Avoid Smoke Leaks

Smoke leaks through holes in the flue or at the junctions between pipe sections impart a smoky or rubbery taint to copra. This is one of the most difficult taints for margarine manufacturers to eradicate.

As a routine procedure the flue should be examined from furnace to smoke-stack each Monday morning before drying is commenced. A small preliminary fire in the furnace will lead to the discovery of all leaks.

Quite apart from removing the threat of smoke taint from the copra, these regular examinations sometimes disclose dangerous holes near the furnace end. If not found and repaired they become the point of origin of a drier fire.

Leaks at flue joints should be plugged with fire clay. Holes should be covered with iron sheeting bound on with wire, the joints being packed with fire clay. In the case of large holes, the section of flue involved should be replaced with a new pipe.

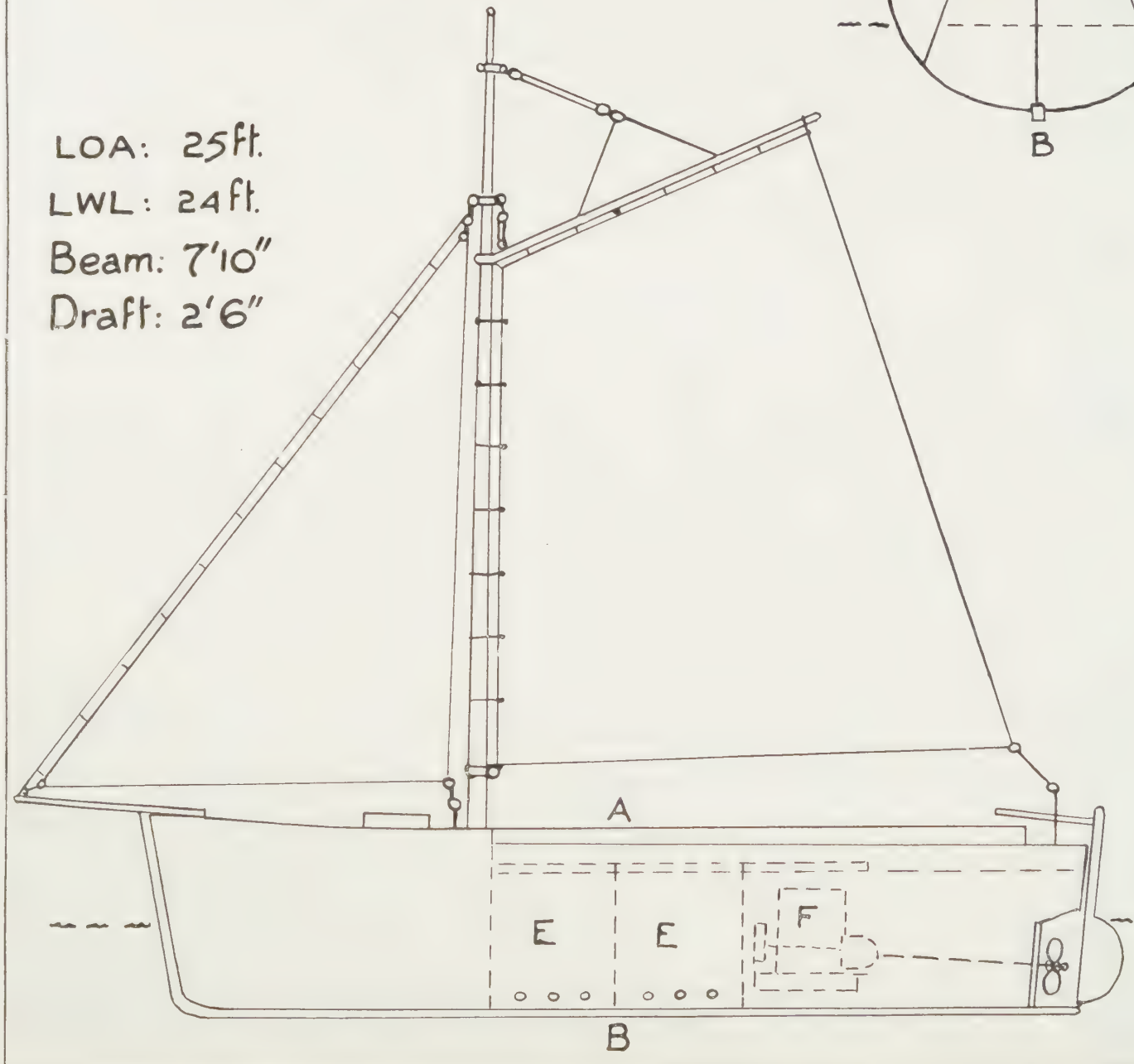
Cleaning Furnace, Ash Pit And Flue Pipes

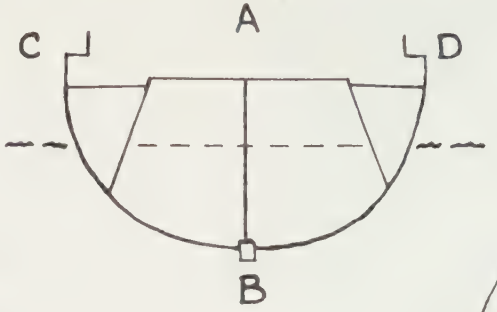
A hot-air drier cannot operate with maximum efficiency with its furnace or flue clogged with soot and ashes. In well-designed driers, inspection and

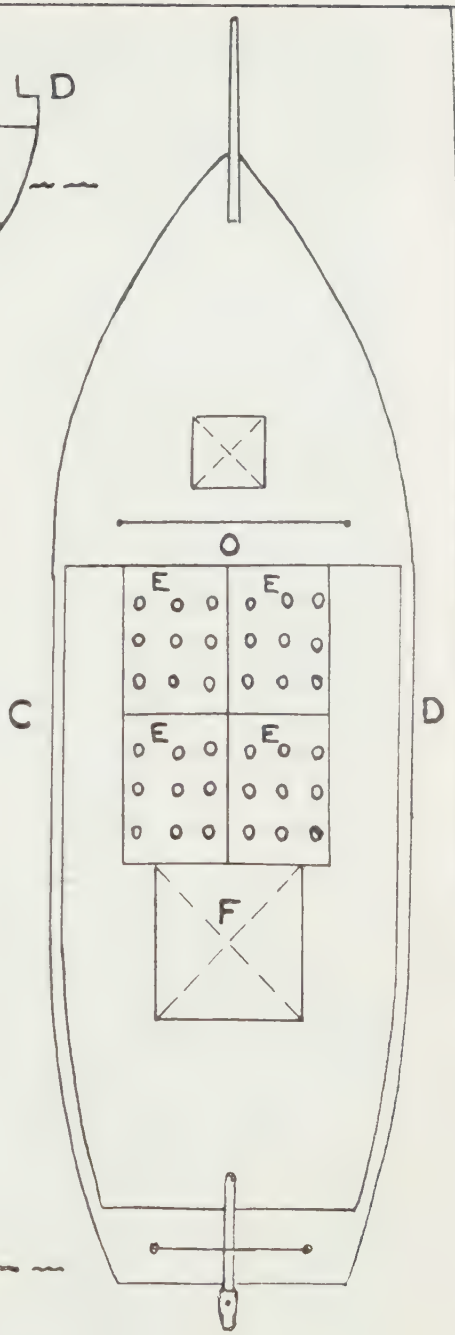
(Continued on page 62)

MOTOR FISHING BOAT
WITH FOUR FISH WELLS
SCALE: 1-50

LOA: 25ft.
LWL: 24ft.
Beam: 7'10"
Draft: 2'6"







Motor fishing boats in Noumea harbour. The graceful sheer and long curved bowsprit are characteristic. Gaff-rigged, with large reaching head-sail, they can take full advantage of the prevailing south-east trade winds. Both sail and motor are often used together.

25-Foot Motor Fishing Boat For Pacific Waters

This 25-foot fishing boat, equipped with both motor and sail, was designed specially for Pacific conditions and is described below by South Pacific Commission fisheries officer . . .

H. van PEL

CANOES form the bulk of fishing craft used in the South Pacific Commission's area. For this reason fishing generally takes place inside the lagoons, on reefs or in river estuaries. Weather permitting, some fishermen venture outside the lagoon or some distance off shore, but, as a rule, fishing out of sight of land is considered too dangerous.

A consequence of this state of affairs is that, near towns and villages, the sea is subjected to comparatively intensive fishing, while grounds rich in fish, shell and other resources may lie neglected a few miles away.

Small punts like that in the foreground are commonly used as tenders for fishing boats operating in New Caledonian waters. Floating astern of the punt is one of the submerged slatted crates to which fishermen on reaching port transfer their catch from the fish wells in their boats. Later, the fish are again transferred by scoop net to wheeled tanks of seawater for delivery to the nearby fish market, where they are sold alive.

How can we help people to make use of these new grounds?

One immediately thinks of larger boats, preferably equipped with engines. Such craft are already being used with success in a few territories, especially in French Oceania and New Caledonia. However, motor fishing-boats could bring improvements to many other places where favourable conditions are found: a demand for fish, facilities for repairing boats and engines, fuel supply, good fishermen and possibly even boat-builders or carpenters capable of producing simple craft. I am sure the latter could, with some extra training, build simple but adequate motor boats.

Obviously, different conditions prevailing in various islands call for different types of boats, and places offering no sheltered anchorages in rough weather could certainly not use motor craft.

Generally speaking, small motor boats are more likely to be successful than large ones. Fishing vessels like those used in the South Pacific by Japanese fishermen are in most cases unsuitable for Pacific islanders. Repairing and servicing such boats would, for example, be extremely difficult or even impossible in many islands.

Our aim should therefore be to find types of boats which can be repaired and serviced locally. Six factors of great importance should be kept in mind:

The boat must be seaworthy;

—she should be adaptable to a variety of fishing methods;

—she should be rigged for sail as well as motor to provide safety in case of mechanical breakdown;

—food and personal effects should be kept dry;

—the fish must be kept in good condition for a fairly long time;

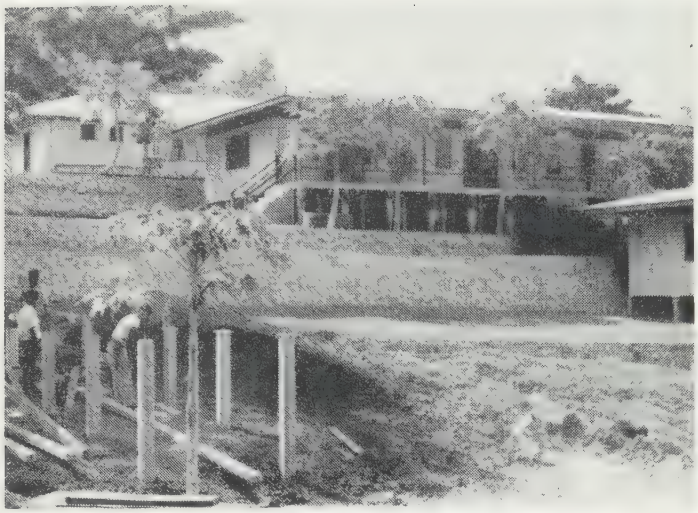
—the boat should be of a type which can be repaired and serviced locally.

Special Design Incorporates Above Features

All these requirements have been observed in the preparation of the accompanying sketch (opposite) of a 25-foot fishing boat, rigged for motor and sail.

This boat has sufficient draught and beam to stand up well in a choppy sea, and the four live fish wells give her added stability. The deck is free of obstacles, so that a variety of fishing methods may be used aboard this craft.

(Continued on page 51)



Above: Co-operative Educational Centre buildings. In the background is the ablution block, completely modern in equipment. The centre building is one of the two dormitories, which each accommodates twenty students. In the foreground (corner only showing) is the dining room and kitchen. Right: Another view showing part of the main classroom building in the background, and part of the dining room and kitchen (centre). The building under construction in the foreground of both pictures is a house for a resident master.

Commission To Hold Co-operatives Meeting At Port Moresby

From July 21 to August 1 about twenty co-operative officers and administration officials from many South Pacific territories will attend a meeting on co-operatives arranged by the South Pacific Commission. It will be held in Port Moresby by invitation of the Administration of Papua and New Guinea, which is providing all facilities.

THE meeting will be held in the Co-operatives Educational Centre at Konedobu, which has been made available by the trustees.

The purpose of the conference is to provide an opportunity for specialist co-operative officers and other officials of South Pacific administrations to discuss their problems and views on co-operatives, including economic development through co-operative organizations.

The discussions will cover such aspects as techniques connected with the formation and guidance of co-operative societies, the relationship of normal government institutions to co-operative societies, consideration of particular types of co-operative organizations considered to be useful in Pacific territories, and training for co-operative staffs.

The meeting will also study and report on the extent to which the South Pacific Commission's help would be useful to territorial administrations in their co-operative activities.

The Co-operative Educational Centre

The Co-operative Educational Centre at Konedobu, where the meeting will be held, trains students for positions as officers and employees of native co-operative societies throughout the territory. These societies subscribed £13,000 of the total cost of £20,000 for building and equipping the Centre, the balance of £7,000 being provided by the Commonwealth Bank of Australia as a grant from its Rural Credits Development Fund.

Since it first opened in March 1956 the Centre has conducted six courses and trained 107 young men for positions in co-operative organizations.

In the territory there are now 214 co-operative societies, 12 associations of societies and one federation of native associations. All have given financial support to the Centre, and have received benefits from it through the training of their officials and employees.

Papua and New Guinea students studying for their certificates as masters of vessels under 50 tons. Ten of the twelve students are men with considerable practical seagoing experience in territory waters. This was a special short-term course held before the 1958 opening of the school's regular courses for co-operative storemen and inspectors.

FOREWORD BY THE DIRECTOR OF MEDICAL SERVICES, FIJI

When Mr. H. W. Simmonds asked me to write a foreword to his article THE HOUSEFLY PROBLEM IN FIJI AND SAMOA *I agreed with considerable pleasure as I had found the article fascinating in the extreme and, I believe, worthy of world-wide attention.*

The menace of the housefly to health cannot be over-emphasized, and public health workers have spent much time and effort in attempting to devise means whereby this pest can be eliminated. In his article, Mr. Simmonds outlines methods of biological control of the housefly, the success of which can be demonstrated clearly in Fiji today.

The author of this article is to be congratulated not only on the pioneer work which he has himself achieved and for which he deserves the widest recognition, but for re-opening a most important field of research which should be pursued with vigour by all those concerned in the prevention of disease.

P. W. DILL-RUSSELL
DIRECTOR OF MEDICAL SERVICES, FIJI.

Bullocks ploughing in a cane district in Fiji. When it was established there that cattle droppings were the main breeding medium for houseflies, a search began for a parasite or predator that might provide some measure of control

The Housefly Problem in Fiji and Samoa

By HUBERT W. SIMMONDS*

EARLY accounts bear witness to the appalling abundance of houseflies in certain of the Pacific Islands, accompanied as they were by a general incidence of typhoid and severe epidemic outbreaks of various types of dysentery, including the severe "Shiga" form. There was also much eye disease (*Cika*) among the Fijian population, often leading to blindness, while many wound infections must have been due to these pests.

In his book *Dysentery in Fiji* (1910), Dr. P. H. Bahr stated . . .

PAGE 22. "House-flies (*Musca domestica*) constitute a great plague in Fiji. They swarm during the hot weather (November to April) in Suva; in the sugar districts they are prevalent throughout the year".

PAGE 23. "The phenomenal prevalence of flies in Fiji, the great frequency of dysentery there, the concurrence of the fly season with the dysentery season . . . are distinctly in favour of regarding Fijian epidemic dysentery as a fly-borne disease".

PAGE 9. "The abolition of epidemic dysentery in a town of the size and importance of Suva, depends upon an efficient sanitation, mainly directed against the house-fly".

In a report by the same officer, which was laid on the table of the Legislative Council in June 1911, he further states that on two occasions he was able to isolate the dangerous "Shiga" bacillus from the intestines of houseflies.

The above will give some indication of the prevalence and dangerous nature of the pest at that time. Fiji was then considered anything but a healthy place in which to reside. Somewhere about 1912 or a little earlier, a decided improvement was noticed. This was generally attributed to the work of an ant, *Pheidole megacephala,* which had accidentally gained entrance to the Colony a short time previously. That this was so was actually shown to be the case by Professor Illingworth and has since been amply confirmed by the writer.

Despite this improvement the pest continued to assume major proportions in the sugar and cattle districts of the Group, and seasonally in Suva itself. So severe was the incidence of the pest that in November 1919, when the writer was staying at an hotel in one of the sugar districts, they so blackened the ceiling of the dining-room that he wondered where the next one would find a place to settle. Late in 1927 they were in such numbers in Suva that spraying of the kitchens of his residence followed by sweeping yielded in three nights, seventy-seven, eighty-five and one hundred and seven.

The European housefly, with which the Fijian species was at that time supposed to be identical,[1] does not breed in cattle droppings as they lie in the field, but as a rule in stable manure.[2] Nevertheless the incidence of these severe outbreaks suggested that they were connected with cattle, though previous search not only by the writer but by several other officers had failed to discover either maggots or puparia. Nor had we been able to find any other media which would account for the numbers or periodic nature of the Suva outbreaks.

Towards the end of 1927 they were in such numbers in Suva that the writer decided again to go into the matter of the cattle droppings, which media alone seemed capable of supporting such swarms, and on January 22 he found

* Formerly Government Entomologist, Fiji. Mr. Simmonds is a member of the Rhinoceros Beetle Technical Advisory Committee set up by the South Pacific Commission in 1955.

[1] The writer is of opinion that it is biologically distinct.

[2] It was in this media that Illingworth made his observation.

An enlarged photograph of Platylister Chinensis beetles which devour fly maggots. The large beetle on the right is approximately $\frac{3}{8}$" long.

them breeding there in appalling numbers. In the course of the work that followed it soon became evident how it was that our previous searching had been unsuccessful.

Having now located whence the great majority of the pest originated it became necessary to make a study of the habits and preferences of the insect in the hope of later being able to bring it under some measure of control, a hope in which we finally succeeded beyond expectation.

During this work it was found that the adults showed a marked preference for human faeces as a food over honey and water, but preferred bread to sugar; they also showed that the fly could and would breed in human faeces, also in bread if damp. While from the health point of view human faeces constituted the principal danger, flies were also observed feeding upon human sputum, the faeces of birds and upon the discharge from a human boil. They also have a habit of going to any sore or wound.

Life Cycle Investigations

Investigations into the life cycle of the insect showed that the female fly deposited her eggs in the folds which were formed in the crust of the droppings as it dried, several flies often using the same fold. In warm summer weather these eggs took nine hours to hatch. If the dropping dried out sufficiently in this time for the ants to run over it they quickly removed all eggs, and that was the reason that we had not come across the maggots in our earlier search. Under certain atmospheric conditions, especially in the warm moist summer weather, the eggs hatched before this took place and once inside the dropping, the maggots were safe from these enemies.

We had however expected to find puparia in the older droppings, but it was now found that the maggots left the dropping when ready to pupate and wandered about until they found a fairly dry situation. In the laboratory they would do this for as long as five days, but eventually had to pupate. In the field the puparia were normally found an inch or two in the soil, often in the roots of grass and sometimes a long distance from any dropping. Pupae collected in the field were found to be parasitised to a limited extent by a Spalangia, *S. muscidarum* Rich. and rarely by a species of Eucoile.

Since it was now evident that cattle were the principal source of the pest—even in the sugar districts, where bullocks were at that time the chief source of power for ploughing—the destruction of their droppings would not be a practical proposition. Attention was turned to the possibility of introducing parasites or predators which might exercise some measure of control.

The first introduction was another Spalangia followed by a Copriid, *Copris incertus*, both through the good offices of the Hawaiian Sugar Planters' Association. While the latter did quite well its activities were of little value, being too slow in its action. It had been thought that if the dropping could be buried quickly, any material left would dry out and be useless as a breeding media. Probably one of the large African species would have been of greater value.

Attention was now turned to predatory insects, and with the kind co-operation of the Imperial Entomological Institute a strong colony of another fly, *Mesembrina meridiana*, was obtained from the United Kingdom. While these arrived in good order they struck a prolonged spell of bad weather when they were emerging, and failed to establish themselves.

Successful Predator Found

Meanwhile, when working in Malaya on the *Levuana* moth the writer had been struck by the scarcity of flies, both in Malaya and Java, and as he knew that predatory beetles of the genus Hister were present in Africa and India, thought it probable that one of them might be

(Continued on page 47)

Fly maggots breeding in cattle droppings.

Young lemon tree at start of bearing.

Citrus Cultivation

Pacific island planters interested in growing citrus will find much useful information in CITRUS GROWING IN AUSTRALIA, *by F. T. Bowman, published recently by Angus and Robertson of Sydney, and reviewed below by . . .*

J. C. GERLACH

Agronomist, Tropical Section, Department of Agriculture, New Zealand.

CITRUS Growing In Australia, written by F. T. Bowman, Principal Fruit Research Officer of the Department of Agriculture in New South Wales, is not "just another book on citrus", but can be considered as a most valuable universal handbook for the citrus-grower in Australia.

A surprising amount of scientific and practical information on citrus, based on experience and results obtained in Australia and collected from an impressive list of books and publications, is contained in less than 300 pages, written in a clear and concise way.

The book starts with a brief history of the citrus industry in Australia, followed by a modern classification of the citrus varieties. A handy key to genera and species in the Appendix contains mainly the varieties which are, or could be, of importance to the industry and plant breeding in Australia. After a thorough discussion on the selection of variety and rootstock the author passes on to the propagation of the young trees. Due attention is paid to soil and climate in the selection of district and site and the essential factors for meeting the requirements of the citrus plant.

In the following chapters on planting, cultivation and management, Dr. Bowman shows that he is thoroughly conversant with field work by the practical approach and solutions to various problems and handicaps as they occur in his country.

In the chapter on pests and diseases, little attention is paid to the possibilities of biological control, which apparently has not found such a wide application yet as, for example, in the United States. Useful tables on dosage and treatment of various pests and diseases are added in this chapter.

The book finishes with two chapters on cropping, harvesting and preparation of the product for the market.

Scientific Approach Essential

In reading this book one cannot escape the strong impression that the application of modern science in the commercial citrus orchard is a necessity if the grower wants to keep pace with the ever-improving standards of production and quality achieved in the big citrus-producing areas in the world.

Though the intelligent reader finds a lot of information of general use, the book is clearly written in the first place for the commercial grower in Australia. This restriction is noticeable in several parts. The young seedlings, for example, in other countries are transplanted to the nursery beds at an earlier stage, thus obviating the necessity of pruning the taproot, which gives a risk of infection from soil-borne diseases.

Table XVII on page 142 may be correct for Australian conditions, but should not be applied indiscriminately in other countries. Potash, for example, remains soluble at a pH of 9, while magnesium deficiency occurs at a pH below 6 only if the soil itself is low in Mg. It is possible that the author meant that in alkaline soils where calcium is responsible for the high pH, the Ca-K antagonism causes the potash to become less available to the plant. In this case, however, the available calcium is the direct cause, and not the high pH.

Psorosis may occur in other countries earlier than mentioned on page 33. In the Cook Islands, for example, the symptoms of this virus disease were noticed in 5-year and older orchards. The T-cut is generally applied in Australia for budding citrus trees, while the inverted U-cut appeared to be more successful in Indonesia.

With Mr. Bowman's ability to explain matters on a high level in a clear and concise fashion, comprehensible for an intelligent reader with not more than high-school training, the elimination of those restrictions would widen the scope of this book and make it a valuable asset for international use.

A few contradictory statements were apparently overlooked. On page 119, band fertilising under the leaf drop is advocated, while on page 162 the generally accepted practice of spreading the fertiliser over the rooting area is recommended. The wrong impression created in the third line on page 239 that air is chilled by radiation of heat is rectified half-way down the same page with the explanation that the natural radiation of heat from the soil to higher air layers causes the air adjacent to the soil to be chilled. These minor errors, however, do not detract from the great value of this book for the interested reader.

The book is well illustrated. In the copy received for review, the black and white photographs are rather flat and consequently lack clarity of detail, but the colour prints of various citrus fruit are quite attractive.

Above: Kili Island's two hundred acres, viewed from the south-west at 1,000 feet altitude, are ringed by unbroken reef. The village is located near the shore at left centre. Cleared area inland is planted with taro. Right: Juda, 54-year-old head of the ranking kin group on Kili, serves as elected magistrate (mayor). His quiet leadership and innovative genius have speeded the islanders' adaptation to a new life on Kili.

Kili Community In Transition

In 1948, a small community of two hundred and fifty people from the northern Marshalls was settled on the island of Kili, in the southern Marshall Group. This study of the resulting social and economic changes that have occurred was contributed by . . .

LEONARD MASON*

IN 1948 the reef-ringed island of Kili lay abandoned, its thirty years' development as a copra plantation in the southern Marshalls ended by the misfortune of war, its contract labour population returned to island homes, its groves of carefully-spaced trees urgently requiring care. Now, ten years later, Kili's resources support a community of 250 Marshallese who combine copra export and importation of rice, flour, sugar, and tinned meats with the more direct use of abundant coconut reserves, newly-planted stocks of pandanus, banana, taro, and breadfruit, and a limited sea-food supply.

The present population derives from Bikini expatriates who in 1946 were evacuated from that northern Marshalls atoll to make way for nuclear weapons testing by United States agencies. When, after two unfortunate years of residence on inadequate Rongerik Atoll, these displaced people were permanently resettled on Kili Island, they brought with them a way of living that was well adapted to the drier, less productive habitat of their Bikini origin.

Plant food on the northern atoll had been limited to coconut, arrowroot, and pandanus, supplemented by negligible husbandry of pigs and poultry and by trapping of wild birds. The islanders had avoided extreme want only by turning to the more abundant resources of Bikini's reef and lagoon. This subsistence economy, only slightly modified by visits from itinerant traders, was tied to a system of land tenure in which matrilineage membership determined each person's rights in use and inheritance. Each matrilineage was composed of persons closely related through the female line. Male heads of these ranked kin groups acted in concert to provide the socio-political leadership needed for stable community organization. Under American administration after 1944 this leadership was formalized as a council with an elected magistrate as its head.

The isolated island of Kili (thirty miles of open water separate it from the nearest atoll, Jaluit) lacks the finny treasure of Bikini's lagoon. Kili's 200 acres of land equal less than one-sixth the area of Bikini's twenty-five islets. Such shortcomings have been surmounted to some degree by the community's experiments with the wider variety of food plants that commonly thrive in the rain-drenched and fertile soils of the southern Marshalls. In this respect the United States Trust Territory Administration has rendered aid through its Kili Development Project, initiated in 1953 with project manager James Milne, a native of Ebon Atoll, and continued in 1955 by his successor Konto Sandbergen of Jaluit Atoll. Both men had been prepared for their assignment by special training at the University of Hawaii.

Eight years of trial and error have led ex-Bikinians and their Kili-born descendants to a generally successful adaptation to the land. Remarkable changes have occurred in economic and family organization as well as in technology. The individual is emerging more prominently in community affairs though he continues to be identified primarily with his kin group. Some features of the old matrilineal organization seem to be yielding to structural and functional traits more reminiscent of the Euro-american family system.

Land Division

Kili's land and trees are now owned and managed by some twenty of these kin-groups-in-transition. Allocation of real property was conceived and executed in 1954 by the community's own leader.

* Professor of Anthropology, University of Hawaii.

Above: At the village limits begin extensive coconut plantings of pre-war years, when Kili was managed commercially by Japanese Nanyo Boeki Kaisha. When ex-Bikinians arrived in 1948 the groves needed much thinning. Right: Women of Kili process pandanus leaf for floor and sleeping mats and for saleable handicraft. Pandanus supplies were scarce on Kili in 1948, but intensive planting has since remedied this lack.

For several months the project manager had urged the island Council to tackle the problem of land division before extending rehabilitation work into uncleared areas beyond the village limits. But the Council had postponed action principally because of unresolved issues relating to inequities in tenure on Bikini, where some lineages had controlled far more land than size of membership now seemed to merit.

Finally Juda, elected magistrate of the community as well as hereditary leader, devised a plan for assigning Kili's land according to the number of individuals in each of twenty households, the kin-groups-in-transition. This he presented informally to several lineage heads whose holdings on Bikini had been disproportionately large. When these men agreed to support his proposal he took the matter before the Council. Discussion resulted in unanimous approval of Juda's plan.

The well-ordered rows of coconut trees that cover most of the island provided a convenient measure of acreage, and were tallied against the actual number of residents in each household group, beginning at the west end of the village. Absentee members were counted as if present, and the scribe (Council secretary) recorded the names of those assigned to each of twenty parcels of land. The village area, where all dwellings are located, was reserved as communal property.

Family Relationships

The composition of the new landholding groups is no longer entirely consistent with the rule of matrilineality (in which a man's wife and children are not part of his linear kin group), but neither does it accord completely with any other rule.

For example, kin group "X" (Kilians refer to the presently ambiguous social unit as a *bamle*, this being their rendition of the English word "family") comprises three sisters and their children (also the sisters' husbands!) and two brothers; the younger of whom found a wife on a nearby atoll where he lives with her and their children (but only *he* is included in the Kili *bamle*), while the older brother, accompanied by his wife and children, resides with the rest of the *bamle* and all of them share in the group's land. Here the brother and sister bond is still strong but operates in combination with the factor of common residence (this household is made up of four dwelling groups living side by side in one corner of the village). In every *bamle* the Kili residents commonly cook and eat together and co-operate in production of copra and in other activities.

Then, too, there is *bamle* "Y" which appears to abandon the rule of matrilineality though retaining a sense of lineality in combination with a recognition of residence: thus, a man, his wife, an unwed daughter with two children, a married son with wife and children, and a widowed brother and his son. Although land allocation on Kili was decided in terms of residential affiliation on a certain date, the existing residence had been determined previously by a combination of linear and bilateral relationships, the precise arrangement within any *bamle* having resulted from personal considerations of necessity and convenience.

Council Representation

Each kin group on Kili, following the Bikinian tradition, has its male head, the *alab*. *Bamle* members respect the right of their headman to one-quarter of the money income from every bag of copra produced on the group's land and sold to the Kili store. This *alab* share is set aside as a reserve to be drawn upon as needed for emergency by individual or group if the *alab* approves. Periodic contributions required of each *bamle* by the Kili Council for community projects are ordinarily paid from this fund. No instance was observed by the writer in which the headman employed the *alab* share to personal advantage.

Not all *bamle* headmen are represented on the Council at Kili, membership in the governing body having been held to the ten lineage heads who served on Bikini. The same men (except two who died and were replaced) continue in office, although the groups they represent have changed in composition.

Nine new headships have been created in the present socio-economic organization (one additional position is associated with land reserved for the use of the native pastor who sometimes comes from another island in the Marshalls and is appointed for a two-year term). Most of these new positions are filled by younger brothers of Bikini *alabs*. This fractionation of kin groups in the course of the 1954 land allocation without some alteration of the Council membership leaves segments of the Kili population without direct voice in community affairs, a situation that is fraught with potential unrest, some of which is beginning to be realized. Land ownership in the Marshalls has traditionally been associated with the privilege of political participation.

The blurred nature of changing social patterns on Kili is further evidenced by the manner in which the two deceased councillors were succeeded by their own sons rather than by younger brothers or by sons of their sisters, as would have been the case on Bikini. Still another matter on which Kilians re-

Above: When ex-Bikinians came to Kili in 1948 they built a new village under supervision, mainly using materials supplied by the Administration. This dwelling is one of thirty on Kili re-built from salvaged lumber and thatched with local pandanus. Street in foreground is sanded, rest of living area is covered with coral pebbles. Right: The Protestant church on Kili is supported by the entire island population, whose ancestors on Bikini Atoll in 1908 were the last Marshallese to be converted by American mission workers from New England.

main undecided is the basis for recognizing new members of a *bamle*, whether these should be own children or sisters' children or some combination of these and still other relatives—another point of potential conflict of interest within the community.

Compensation For Rights In Bikini

In 1956 the Trust Territory Administration reached an agreement with the Kili Council whereby those persons with land rights in Bikini would be compensated for indefinite use of that atoll by United States agencies. In November 1956 an initial payment of $25,000 in cash was distributed by the Kili Council among some 330 men, women, and children who were regarded as legitimate participants in the settlement.

The councillors, with assistance from younger men who possessed more experience in arithmetical calculation, quickly arrived at a classification of individuals for the purpose of computing the amount to be paid to each kin group. It was decided that every person on Kili in November was to receive $79; each member of the Kili community who was temporarily absent was allotted $75; and each individual who was matrilineally related to a Bikinian lineage but who had made permanent residence elsewhere in the Marshalls was limited to $50, as was also his or her spouse and each of their children.

All payments were made to headmen or their representatives, further distribution among members of the landholding kin groups on Kili being left to the headmen. No *alab* is known to have tried to withhold funds from his group, although shares of children under fifteen years or thereabouts were retained by their parents.

An additional $300,000 was established by the Trust Territory Administration as a trust fund with semi-annual interest payments. The first of these, nearly $5,000, was made at Kili on July 4 1957, when the Council again accepted responsibility for distribution. Past experience, however, had suggested to councillors that another basis of classification might be more desirable. The distinguishing categories were reduced from three to two—(i) each person present on that date on the island was to get $16.75, and (ii), any of the 330 November recipients who was absent from Kili on July 4 would be given $10.25.

It should be noted that in November, and again in July, the Council first computed payments in terms of the individual, but then handed the money over to the headman of the kin group to which the individual belonged. This was the same approach adopted by the Council in its 1954 allocation of Kili land. Recent comments on Kili about alternative ways to classify individuals and what amount each should receive suggest that further modification of Council procedures may be expected when the next interest payment is received on Kili. In other words, although every landholding kin group on the island is not directly represented on the Council (kinship ties resulting from considerable inbreeding tend to provide some indirect representation), the local governing body is not entirely deaf to criticism levelled at it by dissenting groups and individuals in the community.

Council Store

At the project manager's suggestion a Council-sponsored store was inaugurated on Kili in 1954 to meet the need for a central receiving and distributing facility. With no capital but a small building, Council and manager embarked on a programme to produce coconut syrup, sennit, and handcrafts from Kili's surplus coconut materials. A ready market for their sale was found among other Marshallese and at the naval air base on Kwajalein.

All profits stayed with the store after each producer had been compensated. Later, all island copra was handled by the store as broker, with sales to various buyers who visited Kili from time to time. Before long the store could buy trade goods for re-sale at a reasonable mark-up to island consumers.

Within less than two years the project manager reported the store's worth at approximately $5,000. More recently the store has entered the wholesale field, and supplies goods to eight or nine modest retail outlets on Kili.

Kilians assert that the store belongs to the Council, by which they mean the community. Although in this sense the people are all shareholders, no dividends have ever been paid—all profits continue to remain with the store. One man did present to the Council a strong demand for payment of his "share", but met with a firm refusal.

Some years back the Kili Council had been keenly embarrassed in a like situation: islanders who had at that time contributed cash to establish a Kili co-operative under Council management later asked for return of their money and

Above: At end of five hours' sailing to cover the thirty miles from Jaluit Atoll, the schooner "Libra" makes her landfall at the north-east end of Kili. "Libra" serves as a lifeline for Kilians, bringing supplies and taking away copra. Right: Kili's single street today is lined with thriving banana, pandanus, and coconut. On the right in the distance are island's dispensary, council house, and store.

all profits, leaving the store without capital for further operation.

Another reason for the Council's present hesitancy to define a share system is that some members wish to limit all benefits to those Kilians who took part in the store's development but others refuse to exclude their absentee kinsmen, many of whom have never set foot upon Kili's rugged shores.

Although Council expression on the matter is yet lacking, it is conceivable that procedures already adopted for land allocation and for distribution of recent settlement funds may suggest a way to solve the problem of the store's ownership, i.e., issuance of shares to kin groups in proportion to size of membership, delegating to each *bamle* the determination of individuals' rights in the store (it is not likely that an entire *bamle* will now withdraw its support from the venture which has proven so vital to the island's economy).

Question has recently been raised by Trust Territory officials about the legal right of the Council to incur debts in its importing of trade goods: while the Council is popularly viewed as synonymous with community it does not truly represent the existing island population insofar as some *bamle* heads are not councillors. Neither is the concept of community well defined with respect to the status of off-island members.

Inter-Island Communication

Communications between Kili and the rest of the Marshalls are hampered by the coral reef that marches unbroken around the little island. From November to May only occasional breaks in the blustery weather permit boat landings from a ship, or canoe launchings through the rough surf, without considerable danger to life and property. This was well realized as a serious problem when ex-Bikinians first settled on Kili, but other favourable features associated with the site tended to obscure the presence of this handicap.

Trust Territory officials have since taken measures to reduce this disadvantage of the reef. Properties on thirty-mile-distant Jaluit Atoll were reserved from Japanese pre-war holdings to provide a lagoon-sheltered site for a small colony of Kilians, and a fifty-foot schooner with auxiliary engine was reconditioned for inclusion in the Kili Development Project with intent that Kilians will eventually take over its operation.

Although weather conditions during winter months are such that wind and sea abate enough at intervals to permit safe anchorage off the Kili reef, commercial vessels originating at Majuro or Kwajalein and following carefully scheduled runs throughout the southwestern Marshalls frequently arrive off Kili in adverse weather, and must perforce continue on to the next stop. Difficulty in serving Kili has been a constant threat to the island's economy; local food production, when not supplemented by trade imports, is still insufficient to meet the community's entire needs.

As part of its development project the Administration has constructed six living units on the Jaluit property and has employed three families from Kili to clear and plant the area.

During the past eighteen months the project ship *Libra,* based at Jaluit and manned by Kilian trainees, has been a welcome innovation in the islanders' view. Radio contact between Kili and Jaluit permits relay of weather data and notice of projected sailings. When conditions are favourable the *Libra* undertakes a quick round trip, delivering trade supplies from a depot on Jaluit and returning with Kili copra.

Some doubt has arisen regarding the feasibility of independent operation of the vessel by the Kili Council unless government subsidy is continued. If the *Libra* or its equivalent is restricted to the Jaluit-Kili trade, as administrative policy now decrees, the island's economy is not broad enough to support the venture unaided. It has been considered to enter the ship into commerce within the southern Marshalls in order to expand the basis of potential revenue, since the *Libra* has not been in uninterrupted operation between Jaluit and Kili. Such procedure, however, would tend to restrict the immediate availability of the vessel for use during the unpredictable breaks in the rougher winter weather. Recent reports of the *Libra's* loss off Kili in a tropical storm may render this an academic question, but in any case no completely satisfactory answer to the Kili reef has yet been proposed.

Integration Within Marshall Islands Society

In the overall view, possibly the most significant aspect of Kili in transition is the progress Kilians are making toward integration within the larger Marshall Islands society. For generations prior to their removal from Bikini, these people as a community experienced more social isolation than other Marshallese because of their marginal geographic location and a traditional preference for marriage within the local group. Even now many Marshallese perceive the ex-Bikinians as different in dialect and other mannerisms.

Kilians, for their part, are reluctant to engage in social intercourse with other Marshallese and timidly admit a cultural inferiority with which they are often charged.

Nonetheless, this socio-cultural insularity has been breached in the last few years. Channels exist by means of which Kilians may in time achieve a more

(Continued on page 46)

Above: Cherax murido Holthius, one of the common crayfish of Paniai Lake, named "murido" by the local people. Reproduction slightly less than life-size. Right: Map of the Wissel Lakes region in west central Netherlands New Guinea. Altitudes are shown in metres. (Nederzettingen bergpapoea's = settlement of mountain Papuans.)

Freshwater Crayfish In Netherlands New Guinea Mountains

Catching freshwater crayfish for food is a regular occupation of Papuans living in the Wissel Lakes region of Netherlands New Guinea. In this way they add some much-needed protein to their diet. This article is especially timely, as one of the tasks of the Commission's fisheries officer who is now working in Netherlands New Guinea is to explore the possibilities of introducing new species of edible pond fish to natural waters of the territory, in order to provide more protein in the local diet.

By L. B. HOLTHUIS*

TWENTY years ago hardly anything was known about the fauna and flora, or the people, of the central mountain region of Netherlands New Guinea. A few expeditions had managed to penetrate into the area, but could spend only a very short time there. It is not surprising, therefore, that it was as late as 1936 that a complex of three fair-sized lakes was discovered in this region.

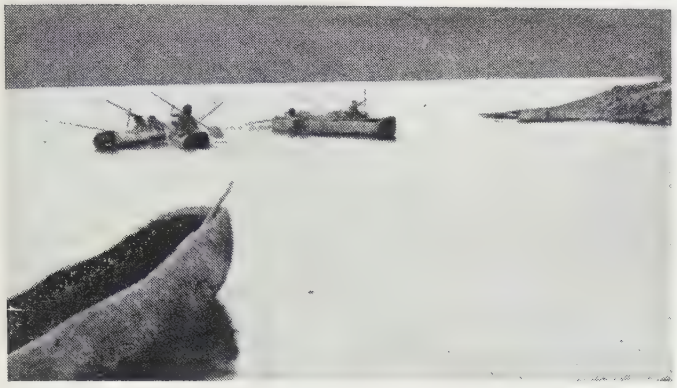
In November 1938 a government post was erected at Enarotali, a native village situated on the shore of Paniai Lake. In World War II, with the advance of the Japanese invasion forces, the government personnel and other white inhabitants of Enarotali were evacuated by air to Australia.

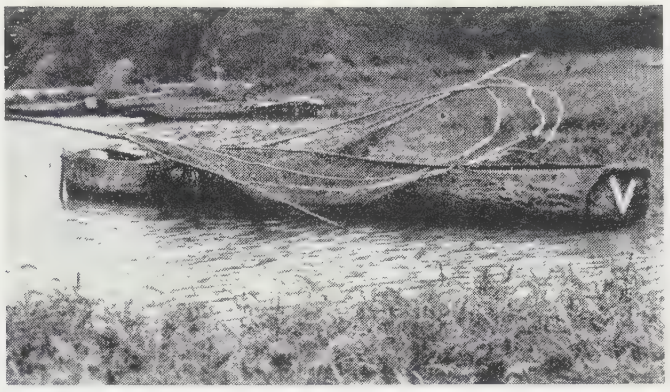
After the war the government post was re-established, and the Protestant and Roman Catholic missionaries also returned. A few missionaries and police officers are stationed elsewhere in the region, but Enarotali is by far the most important white settlement there.

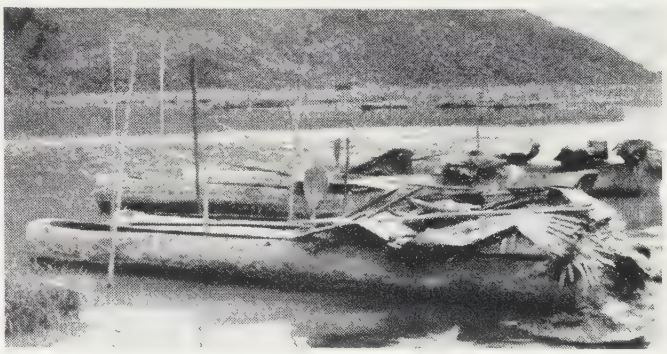
The lakes, which in honour of their discoverer F. J. Wissel were named *Wissel meren* (Wissel Lakes), are three in number. Paniai Lake is the largest. Roughly rectangular, it measures about 9 by 16 km.[1] Tage Lake, the smallest of the three, is elongate, being about 8 km.

* National Museum of Natural History, Leiden, Holland.

[1] One kilometre equals five-eighths of a mile.







Above: Women fishing for crayfish with sink-nets in Tage Lake. The canoes are made from hollowed-out tree trunks, the ends being chopped off square. Right (top): Native canoe with sink-net on Paniai Lake shore. Sink-nets are each mounted on a rattan hoop about 13 feet in diameter, strengthened by a stick bound to it cross-wise. Right (bottom): Native canoes on Paniai Lake shore, showing covering of leaves used as protection against the weather.

long by 3 km. wide. It lies to the south of Paniai Lake, a narrow strip of land separating the two. Tigi Lake, in size intermediate between Paniai and Tage, lies still farther to the south. Roughly triangular in shape, its maximum distance across is about 8 km.

Tage Lake is highest, being at an altitude of 1749 m. above sea-level. The altitude of Paniai Lake is 1742 m. and that of Tigi Lake 1640 m. Several rivers of varying size enter the lakes, but each possesses only a single effluent river. In the case of Tage Lake this is the Dimija River, which connects Tage with Paniai Lake by crossing the narrow strip of land separating the two. For the first 40 m. the Dimija River is subterranean; at a point on the northern shore of Tage Lake the water disappears among the rocks, to appear suddenly some distance to the north as a sizeable brook which is navigable for its entire length by native canoes.

The effluent of Paniai Lake is a large river which leads to the sea. In its upper reaches it is named Jawej by the natives. Near the south coast of New Guinea the Jawej joins the Oeta River, which empties in the Arafura Sea. Tige Lake is connected with the Jawej River by a subterranean stream which starts at the south-east end of the lake, near the native village of Meijepa.

In some places the shores of the lakes, of calcareous rocks, are very steep. The water is quite deep close inshore. In other localities, especially near the mouths of the rivers, the shores are low and swampy, and the depth increases very gradually from the shore.

Large parts of Paniai Lake are quite deep, around 30 m. Greatest depth is 50 m. Tage Lake is on the whole also fairly deep. Tigi Lake is, however, for the larger part rather shallow.

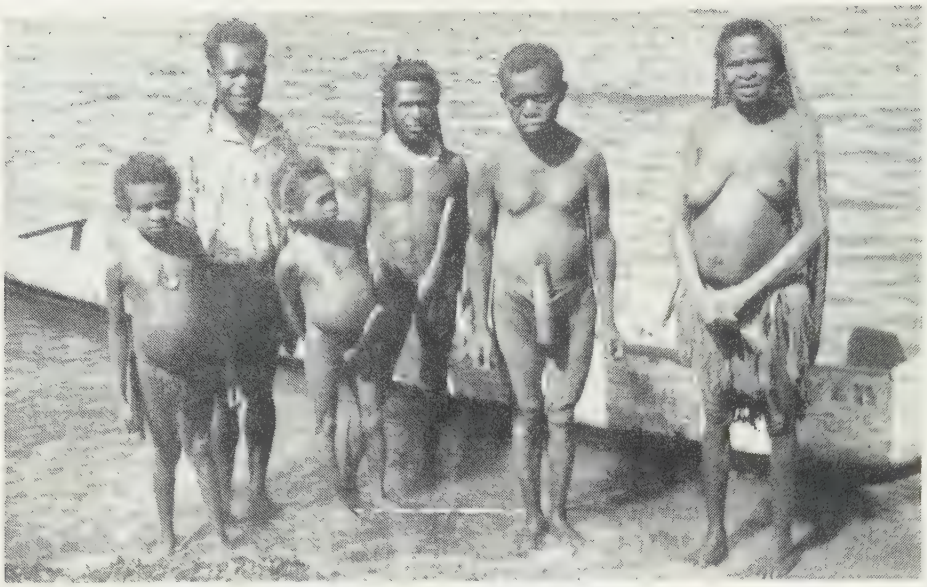
The aquatic vegetation of the lakes in the shallow parts is quite dense, consisting mainly of what we took to be pond weeds (*Potamogeton*) and stoneworts (*Chara*), but of course our identifications cannot be trusted. The few plankton samples taken were rather poor.

Practically all the reports dealing with the economic situation of the population of the Wissel Lake area mention the fact that crayfish occur in large numbers in the lakes, and that they are fished for there extensively by the natives. Freshwater crayfish have always played an important role in zoogeography[2], and they may be considered to be the special pets of the students of this branch of zoology. In itself the distribution of the superfamily Astacidea, which contains all the freshwater crayfish, is most remarkable by its discontinuity.

This superfamily consists of three families: the Astacidae, the Parastacidae and the Austroastacidae. The Astacidae are found exclusively in the northern hemisphere. The other two families are restricted to the southern hemisphere, their range nowhere touching that of the Astacidae. The Austroastacidae form a

View of Tigi Lake, showing the low swampy shore and some native huts.

[2] Relating to the geographic distribution of these animals.



A native family on the shore of the Jawej River near Paniai Lake, with the author's guide, Bottelier, in European clothes.

very small family, containing two species which are found only in S.E. Australia.

The discontinuous distribution of the Parastacidae, however, is most unusual. Of the eleven genera which form this family, one is exclusively found in South America, one is known only from Madagascar, one is restricted to New Zealand, while the others occur in Australia. Of these Australian crayfish genera, one is found also in New Guinea and the nearby islands. We see thus that crayfish are not found in northern South America, in the larger part of Central America and the West Indies, in the African mainland, and in the whole of Southern Asia.

For the general problems of zoogeography the curious distribution of the whole of the group of freshwater crayfish proves to be of the utmost interest. Likewise the distribution of the Parastacidae in the New Guinea region is very important for the understanding of the zoogeography of that area. The crayfish are found in New Guinea proper, in the Aru Islands and at Misool Island, but not at all in the Malay Archipelago. This, like the presence of marsupials in New Guinea, clearly shows the close affinities of the New Guinea fauna with that of Australia.

The explanation for this phenomenon is sought in the theory that during part of the tertiary or post-tertiary period, the sea level was far lower than it is today, and that at the time New Guinea must have formed part of the Australian continent. This theory is supported by the fact that Australia and New Guinea are situated on a shallow submarine plateau, the Sahul Plateau, which lies less than 200 m. under the actual surface of the sea, and during the tertiary or post-tertiary period may have been dry land. The Aru Islands and Misool also are situated on the Sahul Plateau.

Thorough investigations of the islands just outside the plateau (like the Kei Islands and Ceram) until now have failed to produce any evidence that crayfish do occur there, so that it is practically certain that the range of the Parastacidae in this part of the world coincides with the former extent of the Australian continent. Another very interesting feature is the fact that until now in New Guinea, crayfish have been found only south of the great northwest-southeast watershed. They are not represented in any of the collections made in the basins of the rivers flowing to the north coast of New Guinea. It seems that the central mountain range has been an impassable barrier for these animals.

The crayfish in New Guinea all belong to one genus, namely *Cherax* Erichson. This genus is represented there by several species which are grouped into the two subgenera *Cherax* s.s. and *Astaconephrops* Nobili. This latter subgenus is found in the entire southern part of New Guinea, the separate species also having quite an extensive range of distribution. In Netherlands New Guinea the subgenus *Cherax* has only been found in the Wissel Lakes region, where it is represented by at least eight species.

As already noted, crayfish are an important source of food in the Wissel Lakes area. With the pigs that are raised there, crayfish form practically the only source of protein for the native population. Fish are extremely scarce in the lakes. (One species of *Oxyeleotris* occurs there in small numbers, being found mostly in and near the rivers.)

Fishing for crayfish is mainly carried out by the women. For this operation extensive use is made of praus (native canoes). These are hollowed-out tree trunks with the fore and aft ends squarely chopped off, which makes them rather clumsy in appearance and not too manageable. The paddles consist of a long handle and a broad, oval blade.

In the morning and even at night one sees a considerable number of praus on the lakes. The number fishing every day on Tigi Lake alone was estimated by Mr. Catto, the American missionary of this region, to be about 500, an estimate which is fully supported by my own observations. Fishing in Paniai Lake is probably less intensive, as large parts of it are too deep.

The women fish with nets, adopting two methods. Firstly, they use enormous handnets, which are about 2 m. in diameter, with a long handle of about 4 m. The nets are woven of some kind of string made of fibres, the origin of which is unknown to me. These handnets are used by women who stand upright in the praus and scrape with the nets over the bottom of the lake. With the handle of the net used as a lever over the straight rear end of the prau, the net is hoisted out of the water and then its contents are searched for crayfish. Handnets also are used by women who wade backwards through the shallow parts of the lake, pulling the net through the weeds.

The second method used by the women is with sink-nets. These are circular nets with a diameter of about 4 m. which are kept spread out by a hoop made of a slender rattan twig which surrounds the entire net. A thin stick is fastened crosswise over the net in order to give it more strength.

Dead fish (*Oxyeleotris*) and tubers of *Ipomoea batatas* are fastened with string to this net, which is then lowered to the bottom of the lake in fairly deep spots (about 20 m. depth). A thin rattan string is attached to the net, its free end being fastened to a float, of rattan or bamboo, which indicates the position of the net. After having been left for some time on the bottom of the lake, the net is hoisted to the surface, with the crayfish which, attracted by the bait, have ventured on to it. The crayfish are kept alive in woven bags.

The praus generally are manned by women, who sometimes take their children with them. The praus may carry covers of large leaves, under which the women and children find shelter from wet weather. Generally, fire is also carried in the canoes in the form of one or more rather thick smouldering branches placed on a layer of sand on the bottom. Sometimes a small fire is made in the boat which, then, by the column of smoke, gives the queer impression of being a small steamer.

In the boats the nets are carried on two sticks which are placed crosswise, each sticking out over one side of the boat. In Tigi Lake we observed the women leaving the village in the morning walking with the woven nets to the shore of the lake, where the wooden and rattan parts of the nets had been left lying overnight in the grass. The woven part of the net then was fastened to the

hoop, and everything was loaded into the canoe, after which the new day's labour could begin.

In Paniai we sometimes saw the praus at night on the lake, the fires in the canoes then indicating their presence. The fires were badly needed, as the nights are very cool in this region, and as the natives, apart from a scanty pubic cover (a grass skirt for the women, a pubic gourd for the men) and some ornaments, wear no clothing at all.

In the afternoon, fishing is impossible, as around one o'clock a strong north-west wind starts blowing across the lake, producing waves which constitute a danger for the praus. For this reason, the women always leave the lake at the end of the morning.

The men, too, catch crayfish, but never on such an extensive scale as the women. I received the strong impression that catching crayfish is for the men more of a sport, while for the women it is an important task. The men do not use nets but obtain their prey by diving. They jump overboard or dive near the shore for the crayfish hiding under rocks.

In the early reports concerning the Wissel Lakes mention is made that crayfish were fished for with spears and with bows and arrows. That this method of fishing was actually used was borne out by the material brought home by the 1939 expedition, which contained a fair number of specimens of crayfish with holes in the carapace, or abdomen.

However, during my visit I nowhere observed it in use, and on enquiry was told it is not now employed. The only thing that looked something like it was carried out by two small girls of about four and seven years, who in the Jawej River were hunting shrimps (*Macrobrachium* spec.) with a kind of fish-spear, a thin bamboo stick ending in about five diverging prongs. The spear is thrust over a shrimp, which is caught between the prongs. The latter are very blunt and they do not—and in fact could not—piece the shrimp.

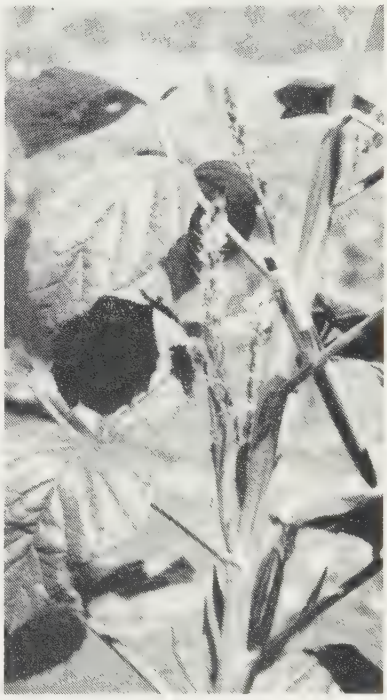
There are reports that crayfish are not fished for during a certain season, but no positive confirmation could be obtained. When at the end of February I asked for a certain kind of crayfish I had obtained abundantly in January, I was told it was unobtainable because it "had left" (for deeper water?). There may be a migration which at times results in the absence of crayfish from shallow waters, but this is still one of the points about which we know little.

The guar, or cluster bean, useful not only as a food plant, but also as a fodder, a ground crop and for green manuring.

Guar pods, edible when young.

A Useful Plant Grown In Fiji

By Jacques Barrau



Guar flower. Pencil indicates size.

In some Indian vegetable gardens in Viti Levu may be found a legume grown for its edible pods. This is the "Guar" or "cluster bean", Cyamopsis psoralioides *D.C.* (C. tetragonolobus *Taub.*). *While the seeds are sometimes eaten, the young pods are mostly used. They are on sale occasionally on the market in Suva.*

The plant is little known in the South Pacific. It is useful not only as a food plant but also as a fodder, a ground crop and for green manuring, according to H. F. MacMillan (Tropical Planting and Gardening, *London, 1954*).

This plant could thrive in any South Pacific island receiving from 40" to 80" of rainfall annually.

Recently the Guar became the subject of increasing interest in the United States as a possible new crop for the south-west part of that country. The reason is that the seeds of C. psoralioides *can be processed in a flour yielding a gum, manno-galactan, which has a wide range of industrial uses.*

According to a report from the United States Congress Commission on the increased industrial use of agricultural products (Washington 1957) this gum can be used in paper, rubber, textiles, cosmetics, pharmaceutical and food industries. For the last-named it is useful in the industrial processing of ice cream mixes, cheese-spread and salad-dressing.

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Bunch (above) and fruit (below) of the wild banana found in New Caledonia.

Wild Banana From New Caledonia

FOLLOWING a request from Mr. N. W. Simmonds, the well-known eytogenitist of the Imperial College of Tropical Agriculture at Trinidad, Dr. J. Barrau, SPC plant introduction officer, last January made a field trip into the interior of New Caledonia to find a wild species of banana earlier reported to be growing in the mountains.

It was found near Touho, on the east coast of the island. Seeds were collected and sent to Trinidad. According to Dr. Barrau the species is probably *Musa banksii,* also known as *M. acuminata,* subspecies *banksii. M. acuminata* is today considered to be one of the wild species from which by hybridization evolved the cultivated varieties of bananas.

The "Tagula" is 60' long with a beam of 18' and draft of 7'. Designed in Scotland and built in Brisbane, she embodies the experience gained from fishing surveys carried out in Papuan waters since 1948.

Fishing Industry Develops In Papua and New Guinea

While at present, annual imports of fish to Papua and New Guinea are valued at approximately £A275,000, it is hoped that eventually the territory's entire fish requirements will be produced locally. With this objective in view the Administration is steadily developing the fishing industry according to a plan adopted in 1956.

TO implement its programme for fisheries expansion, the Administration is building up its fisheries staff and is training native fishery assistants to work in the villages.

Demonstrations of modern fishing gear are being given to Papuan fishermen to encourage them to use latest techniques. Inland peoples are growing fresh water fish in village ponds.

New Fisheries Research Vessel

A new fisheries research vessel, the *Tagula,* is operating off the southern coast of Papua. She is 60 ft. long with a beam of 18 ft. and draught of 7 ft., and has accommodation for a European master-engineer, three technical staff and a crew of ten Papuans.

The refrigerator installed is capable of freezing one ton of fish in sixteen hours. Its maximum capacity is five tons. There is an additional five tons holding room only, without refrigerated coils.

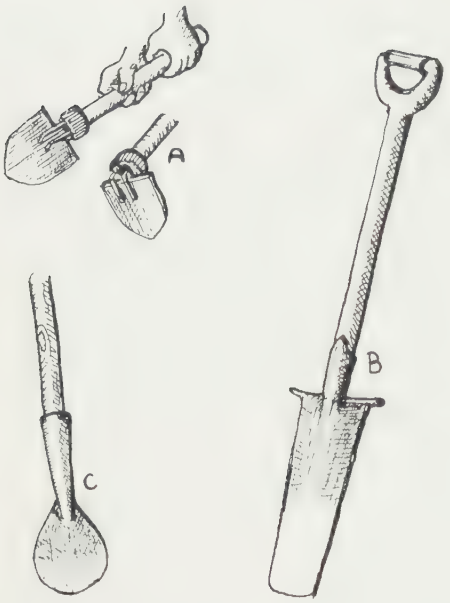
Navigation and fishing aids comprise a two-way radio and an echo-sounder and oscilloscope, or viewing unit, with a range of up to 480 fathoms.

The main engine is a 140 h.p. diesel, giving the vessel a cruising speed of 8½ knots with a fuel consumption of 5 gallons an hour. Cruising range is 1,200 miles.

Deep-Sea Fishing Demonstrations

As an important part of the fisheries programme the *Tagula* is demonstrating commercial fishing techniques in Coral Sea waters, to encourage private enterprise to provide adequate fish supplies for the expanding populations of Port Moresby and other centres in Papua and New Guinea.

In the valley are demonstration tilapia ponds constructed at Goroka in the Eastern Highlands by the Department of Agriculture, Stock and Fisheries. Tilapia bred in them are distributed throughout the Highlands.



A: This U.S. Army entrenching tool is a favourite gardening implement with the highlanders of Netherlands New Guinea. B: Draining spade used by yam growers in the New Hebrides. C: Whaler's blubber spade, a popular gardening tool in the Cook Islands.

From Digging Stick To Machine-Drawn Plough

The main horticultural tool of the Pacific islanders used to be the digging stick, with its more or less spoon-shaped extremity. While still in use in many islands, in others where the impact of European influence has been stronger it has gradually been replaced by metal hand tools. In this article the author traces the evolution of gardening implements commonly used in the Pacific. He then examines problems of mechanizing agriculture in the region, and gives brief details of the South Pacific Commission's service for the exchange of technical information on the various types of tools, tractors and agricultural equipment now in use in the islands.

By JACQUES BARRAU*

"AGRICULTURAL machinery is demonstrated to farmers too poor to afford its purchase and upkeep, and with farms too small for its effective use, when what they need is an improved hoe or plough."

This finding by a UNESCO survey team[1] illustrates the risks involved and difficulties encountered in the development of agricultural mechanization in tropical areas. Does this mean that any attempt at improving the agricultural equipment used by indigenous farmers should be abandoned and their traditional methods left unchanged? This question is worth discussing for it is raised time and again, particularly in the field of economic development in the South Pacific.

In the minds of many Europeans, agricultural mechanization and progress go hand in hand. Consequently, when in charge of development projects in the territories, they are inclined to generalize regarding mechanization, without taking into account the social problems to which a technical revolution of this kind is bound to give rise. Sometimes they also forget that modern agricultural machinery, as well as the tractors to haul or carry it, cannot always be used with the maximum benefit, either technical or economic, in tropical areas. As opposed to this blind "machine-mindedness", there are those sociologists who would willingly protect the traditional methods and techniques of the indigenous farmers against any outside interference.

In medio stat virtus, and it is this middle course which we must seek. To this end, a brief historical survey of agricultural equipment used in the South Pacific Islands might be of interest.

The main horticultural tool of the islanders used to be the wooden digging-stick, with its more or less spatulate extremity. It is still in use in many islands, but wherever European influence has been felt more strongly, metal hand-tools have gradually replaced it. In many cases, however, this evolution has affected not the tool itself but the material of which it is made: wood in the past, metal today. Thus the crowbar has often replaced the digging-stick but performs the same task.

Elsewhere, more curious changes have occurred. In the Cook Islands the favourite gardening tool is the whaler's blubber spade adopted long ago by the people when Europeans started whale-fishing in Polynesian waters and called at the islands. To this day the blubber spade is imported in the Cook Islands, but only as a gardening tool! In the New Hebrides the draining spade is used by many to cultivate yams.

The crowbar, the whaler's blubber spade and the draining spade are three examples which show clearly that the islanders have adopted those European tools, even non-gardening ones, which are best suited to their own needs and traditional methods of cultivation. This is a lesson not to be forgotten and which will again be referred to later.

Other tools have been adopted: axes and machetes, because they made land reclamation and bush-clearing easier; spades, hoes, weeding-hoes and rakes, because they facilitated soil cultivation and crop maintenance. On the other hand the plough is not widely used by the island peoples except in Guam, where the influence of a long period of Spanish colonization and the introduction, during the seventeenth century, of the Carabao ox, made its adoption easier.

Before the war a few tractors were imported here and there in the South Pacific. However, it was especially during the second World War that mechanization was definitely accepted in the region. In some islands the United States Army used tractors and modern agricultural machinery in order to provide the troops with fresh food. After the war, most of this machinery was left behind, so that some territories, such as New Caledonia, were able to make a start in mechanization. It soon became obvious, however, that not all tractors and other implements were an economically-sound proposition under peace-time conditions.

During the post-war period a few attempts were also made at collective mechanization in indigenous communities such as Nimboran in Netherlands New Guinea, or within the framework of specific agricultural projects such as the rice production project at Mekeo, in Papua. These attempts were not always successful for, generally speaking, the economic and social conditions under which agriculture develops in the South Pacific islands are not favourable to mechanization. Subsistence gardening is done on small patches, widely scattered and often located on hillsides, while the system most commonly used in agriculture is bush fallowing rotation, which similarly hardly lends itself to the use of tractors. This is especially so as the land is often laid out in narrow ridges (along which run draining ditches) or in irrigated terraces on hillsides. The local farmer hardly ever ploughs the entire area of his field or garden but carefully prepares a small patch for each

* Plant Introduction Officer, South Pacific Commission.

planting. Consequently, a plough is of little use to him.

With regard to cash crops, whether coconut or in some territories coffee and cocoa, mechanization under present conditions is not always practicable. The reasons are of a technical nature (closely-planted areas, small patches, difficult land) or an economic nature ("poor" crops such as the coconut). It is therefore understandable that attempts at mechanization in tropical areas have been closely associated with the introduction of either new crops (rice in Papua, peanuts or citrus in the Cook Islands), or new agricultural systems (collective farming at Nimboran). Entirely new conditions have thus been created which theoretically lend themselves to the development of mechanization.

Identical Problems In African Territories

This introductory statement may seem deliberately pessimistic or even hostile to the possibilities of agricultural mechanization in the South Pacific Islands. The author hastens to point out that, at the International Conference on Mechanization of Tropical Agriculture held in 1955 at Entebbe, Uganda, problems identical to those mentioned above were raised with respect to certain large African territories. Communications made at this Congress by Mr. C. F. Charter[2] on behalf of the Gold Coast, and Messrs. R. Tourte and P. Gaudefroy-Desmombynes[3] on behalf of French West Africa, illustrate the point particularly well:

> "Bush fallowing rotation is not conducive to agricultural mechanization . . . The main obstacle to agricultural mechanization is that crops are too poor . . . output is too low . . . prices are too low . . . there is no technical background . . .", and so on.

This information prompted the Entebbe Conference to stress the following points in its recommendations:

Agricultural mechanization should not be carried out rashly;

hand-tools and small animal-drawn implements should be improved;

mechanized implements likely to be of use under tropical conditions should be carefully selected;

drivers and mechanics should be trained to handle tractors and machinery.

These were the points stressed with respect to mechanization in Africa. While the expanse of arable land there is so much vaster and agricultural facilities so much greater than in South Pacific territories, the recommendations may be a useful guide to the solution of agricultural mechanization problems in our own region. To take them in turn:

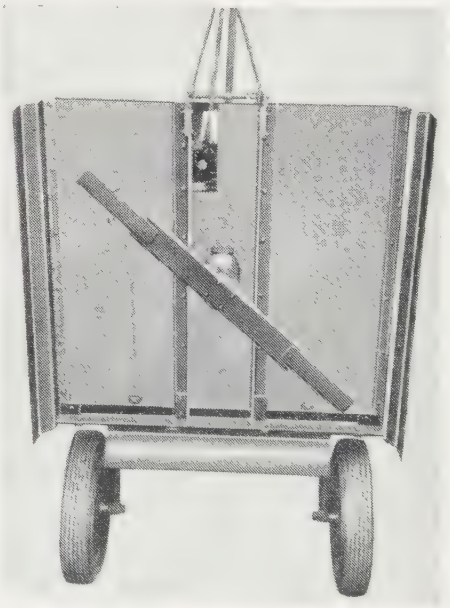
A tractor-drawn rotary cutter at work. Cutting blade is shown at right.

"Agricultural mechanization should not be carried out rashly": Mechanization is not a universal remedy. To pay its way, a tractor and its implements should be kept working on a sufficiently large area generally accepted as being from 50 to 75 acres. As we do not often approach these holdings in our islands, it is easy to understand why tractors left in New Caledonia by the United States Army have, under peace-time conditions, become costly luxuries leading to loss rather than profit. (It is admittedly a fact that these tractors are often ill-adapted to the tasks required of them; today there is a better and wider choice of machines on the market, which makes it easier to obtain the right one for a given job).

Mechanization is certainly possible in the Pacific region; in some instances garden-type and small tractors *are* being used and *do* show a profit. Tractors can also be operated under a co-operative system provided it is well run and proper use and maintenance of the machinery can be ensured.

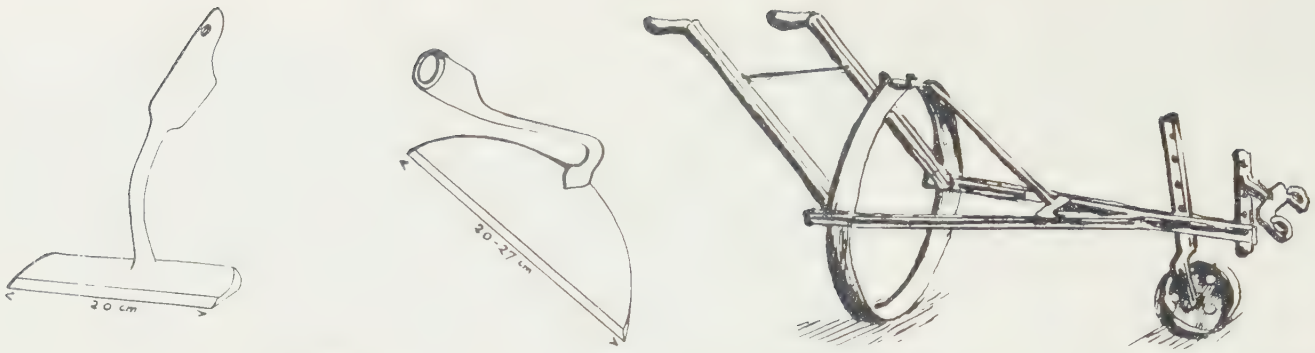
However, these conditions are at present seldom fulfilled. Mechanization in the area is still in its infancy, and we are slowly feeling our way. We have gained some useful experience. For example we know that machinery, whether used on private farms or in communities, must pay for itself; that its use should never involve any risk of soil depreciation; and that the owner must be thoroughly aware of the full costs of running and maintaining it.

"Hand-tools . . . . should be improved": Quite a variety of metal hand-tools are in use in many territories, but



they are not always well adapted to the farmer's needs. It would seem necessary to try and find the right kind of tool for each job. This has already been done for the machete by the *Institut pour l'Etude Agronomique du Congo Belge* (INEAC). The results of this enquiry were published in the *"INEAC Bulletin"*, Volume V, No. 1, February 1956. Also of interest is the communication on *The Problem of Small Agricultural Implements in the Belgian Congo*[4] which Mr. Brixhe made to the Working Party on Agricultural Mechanization in the Belgian Congo in 1954. Brixhe writes:

> "The introduction of new tools must be progressive and adapted not only to



Left: At a meeting held in Brussels in 1954 to study mechanization in the Belgian Congo these tools were recommended for use by the indigenous population there.

Above: There are few agricultural machines specially built for farmers in tropical areas. This, however, is an interesting example of one designed for the African farmer. It is an animal-drawn "peanut lifter".

the soil and vegetation, but also to the mentality and customs of the population."

Let us see how this principle can be applied in the South Pacific. The yam planter in New Caledonia, the taro grower in his damp forests of the Solomons, or the mountain dweller of New Guinea whose main food is sweet potatoes, have neither the same customs nor do they work with the same gardening implements. A great favourite in Netherlands New Guinea is the United States Army entrenching tool, which can be used either as a spade or hoe. It is perfect for the cultivation of sweet potatoes, but would probably be useless for another kind of crop in a different territory.

When searching for the ideal tool for a given population we must remember that our European horticultural implements are not necessarily the best. The crowbar, the whaler's blubber spade, the draining spade and the military entrenching tool were never meant for gardening, and yet the indigenous farmer finds them excellent.

"Mechanized implements likely to be of use under tropical conditions should be carefully selected": Here again the answer is not straightforward. Generally speaking, manufacturers seldom design tractors and machinery especially for tropical areas. The reason is a very simple one and can be simply illustrated by the fact that there are at present 420,000 tractors in use in France as against only 7,000 in its overseas territories. These figures alone explain why manufacturers think mainly in terms of the home market, and it is only the perusal of catalogues which will lead to the discovery of equipment suitable for tropical regions and cultivation.

What are the prevailing trends in tropical mechanization? In Africa, technicians seem to prefer the Diesel tractor with mounted plough and inter-changeable accessories. However, the full maintenance of Diesel engines requires experienced mechanics. All the technicians stress the need for standardizing as much as possible the types of tractors used in any one territory: the fewer the models, the simpler the maintenance.

It is not possible to give a list here of the modern agricultural machinery which might be suitable in the South Pacific islands. However, it does seem that in order to establish perennial crops—which are important in this region—the use of hole-diggers mounted on tractors could make the preparation of seedling holes much easier, while on some plantations the "rotary cutter" and "rotary slasher" types of machine would greatly simplify maintenance work.

"Drivers and mechanics should be trained to handle tractors and machinery": This point is so obvious that it hardly seems necessary to bring it up here, as it is always mentioned in connexion with any form of mechanization in the region. There are training centres already in operation in the South Pacific, and they can be relied on to provide sound agricultural engineers.

The Commission's Role in Agricultural Mechanization

We have examined the problem of agricultural mechanization in the region. What can the South Pacific Commission do to help? First of all, it can (and does) issue information.

In Africa, the Entebbe Conference revealed the need for technical information concerning agricultural tools and machinery, and a number of Information Bureaux have been opened in Europe to fulfil this demand. In particular, for France these include the *Comité du Machinisme Agricole d'Outre-mer* (Committee for Overseas Agricultural Mechanized Equipment), to whom we owe much information, and the *Comité Interafricain de Mécanisation Agricole* (Inter-African Committee on Agricultural Mechanization), whose headquarters are at the National Institute of Agricultural Engineering at Silsoe, in England.

The South Pacific Commission has not the scope of these agencies, but on a much smaller scale we issue information to territories concerning the tools, tractors and machines which would appear to be best suited to their requirements.

It is also important that a system should be developed for the exchange of technical information concerning the results achieved with the various types of tools, tractors, agricultural equipment and machinery already in use in the area. In this respect the Commission would be happy to publish in its *Quarterly Bulletin* contributed articles about farm mechanization in any of the territories within its scope.

ORIGINAL TEXT: FRENCH.

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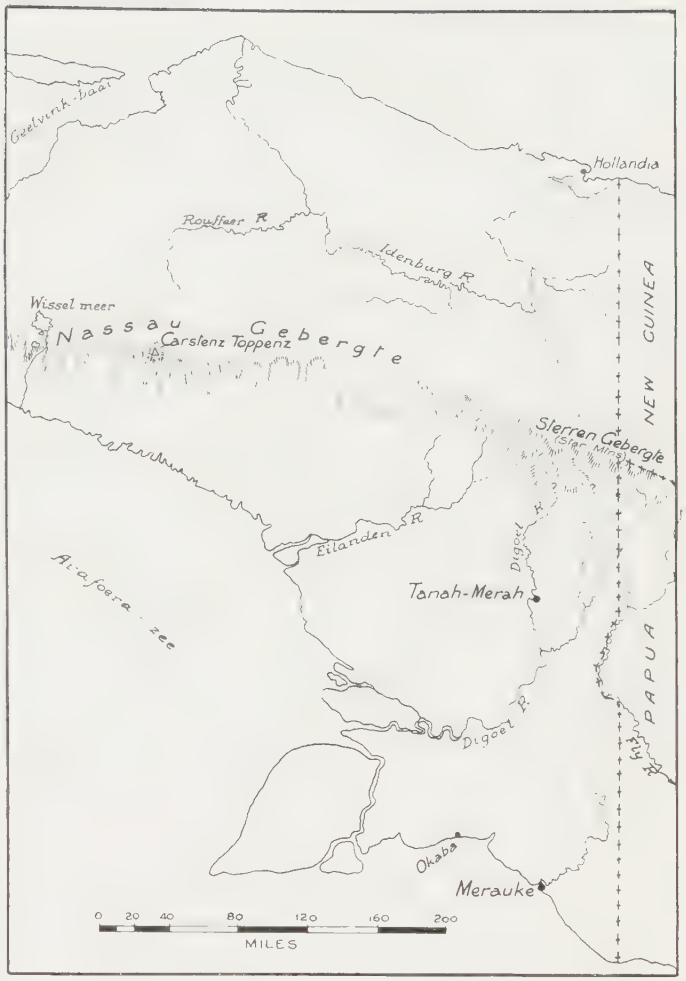
Dutch Expedition To Explore Star Mountains

The largest Dutch expedition ever equipped for exploration in an unknown tropical region will leave in June 1958 for a six months' trip to the practically unopened area of the Sterren Gebergte (Star Mountains) in the central mountain area of the eastern part of Netherlands New Guinea. Base of the expedition will be in the Sibil Valley, 4,000 feet above sea level.



This map shows the Star Mountains in East Netherlands New Guinea. While exploring them the expedition will attempt to find the source of the Digoel River.

THE Netherlands Government is backing the expedition, which is principally a scientific exploration trip during which ten scientists expect to gather exact details of an area of nearly 1,000 square miles, which is still a blank spot on the map.

An effort will be made to find the source of the Digoel River. The expeditionary force, numbering seventy men, hopes to locate minerals. The area which the expedition will penetrate is also rich in valuable beechwood.

Professor Dr. Ir. F. A. Vening Meinesz, the Dutch scientist who in the R.N.N. submarine K18 made a world trip carrying out experiments in gravitation geology and deep-sea sounding, proposed the expedition.

The Royal Netherlands Agricultural Institute and the Netherlands Institute of Physics Research in the East and West Indies have elaborated the plan and have created the Foundation "Expedition Netherlands New Guinea".

The Committee numbers twelve persons, representing all sections interested in the expedition. The Ministers for Defence, Education, Arts and Sciences and the Department of Overseas Parts of the Realm are also interested in the expedition. Their participation, however, does not mean that the expedition will serve a political purpose.

Eight branches of science will profit from the expedition, namely: agrogeology, anthropology, botany, geology, cartography, zoology, ethnography, geography. Valuable information concerning anthropology in particular is certain to be found in the Star Mountains area.

During a preliminary exploration in 1956 a Dutch administrative officer, Mr. Schoorl, met mountain Papuans still living in the Stone Age who had not previously seen white people. Study and

Typical mountainous country in central Netherlands New Guinea, characterized by steep and narrow valleys.

Waipari warriors on the warpath in the interior south of the main mountain range.

research of their primitive civilization will probably yield information about Stone Age peoples which up till now is lacking.

It is uncertain whether these Papuans are peaceful. Their methods of warfare and revenge are very different from the pattern shown by the natives on the south coast. Head-hunting does not prevail in the mountain area, but cannibalism does.

The area will be mapped. The blank spots must disappear by intensive survey of the land which will be aided by the use of an American aerial map. This photogrammetric map and the reports of Mr. Schoorl, later to be supplemented with a report by the leaders of the now-planned expedition—zoologist Dr. L. Brongersma of Leiden and Lieutenant-Commander G. F. Venema (Air), who have both already been in New Guinea—will form the basis for the preliminary detailed working out of the exploration plan. This will be done mainly by aircraft and helicopters. A small aerodrome for a shuttle service is already under construction. Mr. Schoorl has moreover found in the Star Mountain area suitable places to build landing strips.

Civil pilots will maintain air-services and will be supplied with Beaver and Twin Pioneer aircraft which can be used where there are no ordinary modern landing places. A short tarmac will be sufficient. Four Dutch-built "Kolibrie" helicopters will be used for the transport of supplies.

Tanah Merah, on the Digoel River in South-East New Guinea, has been chosen as base for all shipments. This townlet can be reached by small coastal steamers and is favourably situated as a base for further exploration.

Dr. Brongersma is the leader; Lieutenant-Commander Venema will be technical leader and will represent the important part being carried out by the Royal Netherlands Navy in the expedition. A platoon of Royal Netherlands Marines will accompany the expedition, which will comprise a group of ten scientists with ten assistants, an administrative officer of the Government of Netherlands New Guinea, a doctor, an administrator, technicians and a number of members of the Police Force—a total of fifty Europeans and twenty autochthons.

The expedition will have at its disposal aircraft, wireless transmitters and receiving sets and geiger counters to explore for special minerals.

Total costs of the expedition are estimated at £100,000. The Netherlands Government and the Government of Netherlands New Guinea will share part of the costs.

Chairman of the Foundation will be Professor Dr. H. J. Lam of Leiden University, Director of the State Herbarium. Professor Lam represented the Netherlands at the second Pan Indian Ocean Science Congress at Perth in 1954. He was made an honorary doctor of science of the University of Western Australia in 1954.

Kili Community In Transition

(Continued from page 35)

satisfactory relationship with other islanders.

For example, the Kili Church, which is actively supported by the entire resident community, participates in the Association of Marshall Islands Churches, an indigenous society that carries on the work initiated a century ago by Protestant missionaries from Boston and Honolulu.

Meetings of the Marshall Islands Congress on Majuro are attended each year by the Kili magistrate and an associate, where they join with other delegations in debate on policy recommendations to the Trust Territory Administration.

Advanced schools on Majuro and Jaluit receive annually certain youth of Kili who are spiritually and financially aided by Kili's Church and Council.

Natives of Jaluit report that the Kilians who have been working on the colony site on that atoll are fitting well into the local population, especially in church activities.

As noted earlier, many residents of the island regard their kinsmen on other islands as part of the Kili community. Such absentee members constitute another link with Marshallese society; they guarantee some security to Kilians visiting away from home, and introduce new ideas and practices to the parent community through established kin ties.

Kilians of today, both councillors and laymen, have broken through the shell in which they were living, and are groping tentatively and hesitantly for a wider outlook and for richer experiences. If they can learn to think of themselves as Marshallese, not as ex-Bikinians, they should find it easier to dispel some of their present anxieties and to seek more objectively the solutions to those problems which remain from a decade of having to adapt a traditional way of life to a strange physical and social environment.

Note: Field research during the summer of 1957 on Kili Island, on which this progress report is based, was undertaken by the writer while on leave from the University of Hawaii as a Senior Post-doctoral Fellow of the National Science Foundation and with the aid of a grant from the Tri-Institutional Pacific Program.

PICTURE CREDITS

Acknowledgement is made for photographs reproduced in this issue as follows: Pages 16, 17, 18, Arthur Swinfield; 20, 21, 22, Dr. F. A. McClure; 23, 41, 49, Australian Official; 24, 25, W. V. D. Pieris; 26, Louis Devambez; 29, 30, Fiji Official; 32, 33, 34, 35, Professor Leonard Mason; 36, 37, 38, Dr. L. B. Holthius; 39, 40 (bottom), Dr. Jacques Barrau; 45, 46, Netherlands Information Service; 47, from *Citrus Growing In Australia*; 48, Donald Ross, Apia, Western Samoa.

Housefly Problem—*Ctd. from page 30*

found in Malaya. However, enquiries did not produce any satisfactory reply, but when he was asked by the Samoan Administration to return there on rhinoceros beetle work, he suggested, as a reason for Fiji bearing a portion of the cost, that he thought there was some agency holding these pests in check in the cattle districts.

This was in 1938. On arrival in Java he asked whether any agencies were known to be present there which would be of value for the purpose. As flies did not bother them no study of the subject had been made, but they suggested sending a collector out to see what was present in the droppings. When the material was produced next day there was present an Histerid, *Platylister chinensis,* which was of course the very insect wanted. Tests showed that one of these predators could consume from ten to twenty full-grown maggots in twenty-four hours.

Strong colonies were then collected and forwarded to Fiji, Samoa and the Solomon Islands. On returning to Fiji six months later, the writer found that they were already well established.

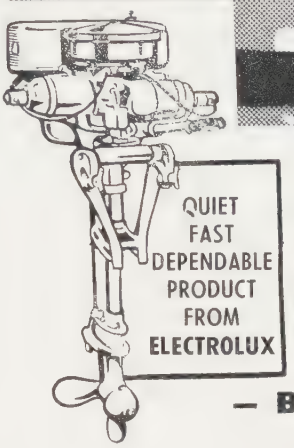
Some time after this the writer left Fiji and was away until 1948. On his return he found that the beetle was widely spread throughout the Colony, and that there was a very marked improvement in the fly position. In Western Samoa also it was doing good work, and when in 1952 he had occasion to visit Apia he found it had become abundant in that area. However, apparently it had not yet reached the southern end of the island, where flies were as bad as ever.

In February 1956 the writer again passed through Apia en route to England, and had five meals ashore while there. During this visit he did not see a single fly in any of the houses visited, and he was informed that it was then only in the breadfruit season, when the ripe fruits were rotting on the ground, that flies became troublesome.

In Suva the position now is that during the hot wet months we generally have one or two come into the room at meal times, or if fish is being cooked a few will come to the kitchen, but during the cooler season of the year it is only an odd one which comes into the house.

To sum up. Two factors, both biological, have brought about this vast improvement, first, the accidental introduction of the ant *Pheiodole megacephala* and, second, the deliberate introduction of the Histerid, *Platylister chinensis.*

It must be added that this predator is not likely to work in certain breeding sites of houseflies such as dumps and latrines, but in such places there can be effective control by normal sanitary methods, and the presence of numerous flies at any time now suggests that some such breeding ground is being overlooked.



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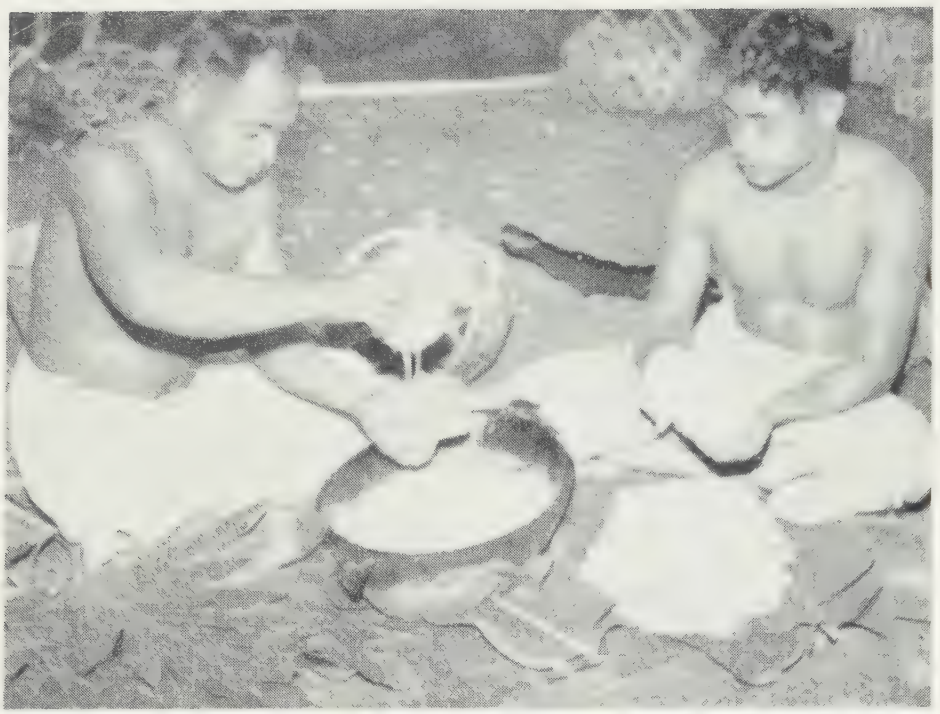
Safe Food In The Village

On many Pacific islands, where heat and humidity favour early deterioration of food, facilities for its safe storage are often primitive. In this article the author describes some of the common causes of food poisoning under such conditions, and gives a few simple rules as a safeguard against food contamination.

By T. C. LONIE*



Cleanliness becomes particularly important when food is prepared by hand, and special care should be taken when many hands are involved in preparing large quantities, as for an island feast.

EVERYONE has to eat and so the preparation and care of food is a most important task in every home, from the smallest and poorest to the highest and best-equipped.

Much has been said about how important it is that people should have enough food. Lessons about how to choose the best and most necessary foods have been incorporated in school syllabuses, and in some places people—especially girls in school—are being taught how to cook in the best way.

The safe and clean handling of food so that it does not become a danger to the consumer is receiving more and more attention by health authorities and food manufacturers in the more advanced countries, nearly all of them outside the tropics. The subject has, however, received very little prominence in the less hygienically-progressive tropical countries, where defective sanitary conditions and ignorance of hygiene plus a warm moist climate provide most favourable circumstances for the spread of disease due to unclean handling of food.

Sometimes one hears people still refer to all food poisoning as "ptomaine" poisoning. Ptomaines are rare chemical substances said to be produced when some forms of food putrefaction take place. It is doubtful if such a thing as food poisoning due to ptomaines actually exists. What people call "ptomaine" poisoning is usually due to ordinary bacterial food poisoning.

Safe And Unsafe Foods

Usually the foods commonly eaten are not in themselves poisonous and where there are such foods, local knowledge of what is good to eat and what is not is usually a safe guide. A study of these local rules and practices can often supply us with the scientific reason for their existence.

For instance, certain fish or parts of fish at certain seasons may be known to be poisonous, and this may be due to the food which that type of fish eats, or even to the particular period in its life cycle at which it is caught, or to some other special peculiarity of the fish itself.

Certain types of manioc are prepared in a particular way so that the highly poisonous acid derived from it is washed out of the product, and where another method of preparation is found it may be that the particular variety of manioc used does not have the poisonous properties of one used elsewhere.

There are many other local food customs with an equally sound basis.

Uncooked Foods

Then there is the question of danger from uncooked foods. This depends particularly upon the method of cultivation and the method of cleansing.

Generally speaking, if animal manure (including human manure and domestic sewage or drainage) is not used in cultivation, or if the foods—usually vegetables—are not exposed to it, there need be no great fear of trouble. The people of the Southern Pacific do not themselves usually use much manure in cultivation, but Asiatic peoples who have had to use very intensive methods of cultivation often make use of this very rich fertiliser, and unfortunately the method brings considerable risks not only of ordinary food poisoning but of contracting worm infections.

Cooking the vegetables is of course the safest plan. Thorough washing in clear running water is a help. Washing in a permanganate solution has been recommended, but is not regarded as having any great advantage over thorough washing in clean running water.

Though much blamed for the spread of various infections, there seems singularly little proof that with reasonable care, uncooked vegetables and salads are anything like so dangerous a source of food poisoning as are animal and fish foods.

"Spoiled" Foods

Generally speaking, food poisoning does not in the main come from the same group of bacteria as cause the "spoiling" of food. The food which goes "bad" is much more likely to be quite uneatable and therefore to be discarded, than is a food which could be quite dangerously contaminated but could yet seem to be quite unaffected in taste, appearance or cooking quality.

Many stores in the tropics now sell cooked meats, often imported in large tins. They sometimes sell them in small quantities, and may keep unsold portions for a longer or shorter time, usually but not necessarily in a refrigerator. For the reasons mentioned earlier there may be considerable danger in this, and very great care must be exercised by stores in the sale of such processed meats.

Equally, the purchaser must decline any such product unless it is in completely satisfactory condition.

* Public Health Officer, South Pacific Commission.

The Fault In Ourselves

The worst of the dangerous organisms are of human origin, and reach the food from the dirty fingers of food handlers. Most of them find their way to the fingers from faeces, but flies which have soiled their bodies on and have eaten faeces and filth of all kinds also contaminate food. Septic cuts and sores on fingers of food handlers are often to blame for food poisoning outbreaks, and contrary to the general position, may be even a danger to the person concerned in preparing—and infecting—the food.

A woman living alone made for herself some soup. She had an infected cut on her finger. After making a meal of the freshly-prepared soup, she found she had enough left over for a further meal next day. The weather was mild and damp, and as she had no refrigerator she put the spare soup on a shelf in her kitchen till the next day, when she had it for her meal. She had apparently infected it from her finger, for a few hours later she became violently ill and died. Soups and broths kept as this was are excellent for the cultivation of bacteria, and the same kind of organism was recovered from the soup left, and from the cut on her finger.

It is not always possible, however, to trace a source as easily as this, and unfortunately there are usually many more people at risk than one. Here is an instance where, not septic fingers, but unwashed fingers and faeces were concerned.

In a certain place about eighty people had a meal, part of which was a pork pie. The following day ten were taken ill with headache, abdominal pain, and some with diarrhoea and vomiting. During the next ten days a further twenty-nine became ill. Two persons who had helped prepare the pie were found to have exactly the same kind of bacteria in their faeces as was isolated from the patients. Doubtless if they had washed their hands before handling the food, this outbreak would not have happened.

Very many similar stories could be recounted. Sometimes a dangerously infected person—carrying dangerous bacteria though not personally sick—can spread a disease at intervals for many years. The author has knowledge of such a person closely identified with the occurrence of a number of cases of typhoid fever over at least eighteen years.

Natural Protection

Although, as has been seen, a person mishandling food can even be a source of danger to himself and to his close contacts, faults in the preparation and preservation of foods are usually not so serious where the single family or household is concerned. There is a great deal in being used to our own particular environment, and this is true also of getting in some measure used to our own particular group of organisms, against which we develop a resistance at a higher level than is found among those outside our particular group. That is why after a group of people—on an island, for instance—have been isolated for a long time, they often cease to be troubled with minor illnesses and infections. They have become protected against the kind of organisms present.

Travelling medical clinics have done much to combat high infant mortality in many Pacific territories by educating people in hygienic methods of infant feeding. Here a father of the village of Tupuslei, near Port Moresby, feeds his son while awaiting his turn to see the clinic doctor.

There is another side of this isolation, of course, and that is that in course of time the body "forgets", as it were, how to deal with other infections, so that when these are introduced again after a long period, an epidemic of one or other of these may sweep the whole place, perhaps quite severely. This is why epidemics of colds and of some infectious diseases appear in isolated places after the isolation has been broken by the visit of a ship. Even if all the people on the ship may seem quite healthy, it may be that they are the carriers of some particular disease germs. Most kinds of food poisoning infections behave in much the same way.

It is, of course, unsafe to rely entirely on "getting used to" our own particular family or group. People move about and do not always eat at home. They visit friends and neighbours, and join them at meals; they eat in eating houses, restaurants, and at public gatherings of all sorts. The larger the number of people gathered together or meals served, the larger the number of food handlers likely to be concerned in preparation, and the greater the risks.

The Public Feast

In the Pacific, the public feast at a village or tribal gathering is an integral part of the way of life. In the thickly-populated islands especially where there is a highly-developed community feeling —whether of district or village or church —the communal meal may be an enormous affair. Hundreds of people may be concerned, and the accumulation of food may take a very long time—may in fact deplete a whole district.

The danger of food poisoning under such circumstances arises in several ways. Because so much is required it is often brought from long distances, and the collecting process begins very early. For food which keeps well, or for food derived from animals or fish which can be kept alive in good conditions until required, the delay is no great matter.

Quite often, however, there is difficulty in collecting and preserving enough in this way, and this is especially the case with perishable foods such as fish, crayfish, shellfish and sometimes meat. All of this may be perfectly good when first obtained and, if cooked early, but what is done sometimes is to cook such food

a few days before it is required, and then in the hope of lengthening its usable life, re-cooking it several times, perhaps every day for two or more days. This is a most dangerous proceeding, because it is impossible to keep food quite free of organisms at all times; and after cooking, and while it is slightly warm or at room temperature, it will have on or in it organisms, from handling, from dust and perhaps from contamination by flies, and these will be multiplying rapidly and in the process setting free poisonous substances called toxins.

Note especially that many sea foods such as crabs, lobsters, crayfish, shellfish are prepared whole, i.e., the gut is not removed as with other foods. From this, apart from faulty handling, bacterial and toxic contamination may spread throughout the article if it is kept too long in the dead state, with or without cooking. When re-cooking takes place, the organisms may be killed but the toxin is usually heat resistant, and will remain in the food. Such toxin may produce a severe food poisoning illness. Meat, fish, and fish products are especially subject to this trouble.

At some social gatherings and in some homes, special made-up meat dishes such as meat pies and pastes, "pressed" meat, jellied meat dishes (like brawn), cooked ham, etc., are favourites. This form of food must have especially careful handling. By its nature it is handled a good deal in preparation, and so is very liable to contamination. As sometimes in making these dishes, pre-cooked meats are used, these may be already contaminated. The "made-up" meat dish is almost an ideal material on which organisms can grow. Again, it is quite often kept for a long period in open containers, or in part-used form.

Soups which are not eaten immediately on preparation or are kept for a day or two, are also dangerous.

Village feasts often provide a large selection of milk products such as custards, trifles, Spanish cream, cream cakes, etc. The cream usually used is artificial cream, which appears to be particularly liable to dangerous contamination.

The reason for the danger in most of these is that the dish, after preparation and while still warm, may be kept to "set" or to "cool" for some hours, even overnight, and during this time any bacteria which have gained access to the dish multiply exceedingly rapidly. Remember that one single bacterium can multiply to more than *two millions* in seven hours under such circumstances.

Pressed beef sandwiches were made for a large number of people—some ate them a few hours after they were made without ill-effects, 500 ate them twenty-five hours later and nearly all became violently ill shortly after. This was not in the tropics. If it had been, the same dangerous result would have occurred very much sooner because of the warmer weather.

What had happened? The person who made up the sandwiches had a septic finger, and had infected the meat. The first group of people ate the sandwiches before the infecting bacteria had time to multiply; by the time the last group ate them the numbers of bacteria had grown to many millions, though even then the sandwiches had not "spoiled".

Of course in some parts of the Pacific, village peoples have not yet reached the stage of presenting such sophisticated dishes to their guests but it is a surprisingly common practice, and in line with the Pacific habits of courtesy whereby one seeks to present to a guest the kind of food to which he may be accustomed and may be expected to appreciate.

A further difficulty which arises here is that very often under such circumstances, the methods of preparation and preservation are not sufficiently well known, and the normal equipment for protecting the food is either absent or insufficient. Once again it is what happens to the dish between the time it is cooked and eaten, and how long that time is that makes the difference.

This is by no means a complete account of food poisoning. It merely points up some aspects of it which are especially important to all who live in the Pacific islands territories whether they are themselves of island origin or not. Disease knows no frontiers of race, and the same processes of infection and of illness have their way whatever the colour of our skins. What we have now to say about prevention equally applies to all. If it repeats some things said previously, that is no matter. They may be more likely to stick in the mind.

A Summary of Prevention

Selection Of Food. Food should be obtained from a clean source and should be fresh when bought. This applies especially to meat and fish. Any article of abnormal colour or appearance, but especially of smell, should be rejected. Fish whose flesh is flabby or discoloured should also be rejected. Here again, and with shellfish, the buyer or user's nose is a good guide.

Tinned food is usually safe provided the tin is in good condition. Reject all badly-damaged tins, or any tins in which the ends of the tin instead of being flat, or "drawn in", are "blown" or rounded out. This is usually due to decomposition and the production of gas under pressure inside the tin. If, on opening, the contents have a bad smell or are discoloured, reject them. It is better to be safe than sorry. When a tin has been opened, empty the contents into a clean dish, and keep covered. Do not leave the food in opened tins. Apart from other possibilities, exposure to air may set up changes between the coating of the tin and the food whereby the latter may become dangerous.

Do not use local foods which experienced residents do not think safe.

Food Storage. Foods such as milk (liquid) and milk products, meat, fish, should be kept in a cool, clean, well-ventilated food cupboard or safe, fly proof and insect proof, but in any event should not be kept any longer than is strictly necessary, and it should be a strict rule that if there is any doubt at all about the wholesomeness of any food—unusualness of appearance or smell, for instance—no risks should be taken, and it will be much safer not to use the suspected article. Cooked and prepared dishes should be used on the day of preparation; it is unsafe to keep them overnight in the tropics without refrigeration.

The use of refrigerators in private homes and in stores is increasing. They permit food to be preserved for a longer time, but they do not enable it to be kept indefinitely, and may lead to a false sense of security. They slow down, but do not arrest, decomposition and the multiplication of bacteria, and a refrigerator which is being constantly opened may never attain a temperature nearly low enough to provide an effective check to spoilage of food already contaminated by bacteria. Ice-boxes are never a satisfactory solution to the problem of food storage in hot weather.

The same rules apply in the case of foods kept in refrigerators and ice-boxes as for those kept in the unrefrigerated food safe. If an article of food appears to be in any respect unsatisfactory in appearance, smell, or taste, it should be discarded without hesitation. Especially should one be wary of the eating of made-up dishes; soups, meat pies, meat pastes, galantines, creams, custards, etc., which have been left over for any length of time.

Dried meats, fish, etc., do not keep well in the tropics, especially in warm damp weather. They should be used only with very great care.

All food safes and refrigerators require to be kept scrupulously clean at all times.

Food Handling. Absolute personal cleanliness is necessary at all times in the handling of food. This applies especially to hands and clothing which may come into contact with food. It may seem unnecessary to say that a person preparing food should wash the hands before doing so. It would seem even more unnecessary to say that any food handler should be especially careful to wash the hands after visiting the W.C. or latrine. Yet it is precisely the failure to do this which is a principal cause of food poisoning outbreaks.

No person with a cut, sore, abscess, or any septic or diseased condition of the hands or arms should be engaged in the handling of food, especially in cook-

ing, or after cooking, or in the preparation of food which it is not intended to cook before serving. A bit of bandage or sticking plaster on the septic finger is no insurance against infecting the food handled.

No person with a cold, running nose, or suffering from a disease in which coughing and spitting are a feature, should engage in the preparation or serving of food. Influenza, measles, whooping cough, tuberculosis, and similar diseases can be spread in this way.

Cleanliness of food itself is also important, and cleanliness of utensils—plates and cups, cooking pans, knives, forks, spoons is equally necessary. It is surely not necessary to say that food should be protected from flies, dogs, cats, rats and mice at all times.

All of these precautions are important, do not require apparatus, and can be applied easily by intelligent people when their necessity is pointed out. There are very few places and very few gatherings where they cannot be applied if a little trouble is taken. Island peoples are quite capable of understanding these matters, and of undertaking the responsibility required, and their co-operation, if sought, will almost certainly be forthcoming.

Much unnecessary suffering may be avoided if due care is exercised. This business of food poisoning is important to every man, woman and child in all South Pacific territories. With good sense, most of the unpleasant, painful, dangerous, perhaps even fatal illness which it is causing every day somewhere in the Pacific, can be got rid of. For most cases it is true to say this: The Cause and Remedy Are In Your Own Hands—KEEP THEM CLEAN AND OFF THE FOOD.

25-Foot Motor Fishing Boat

(Continued from page 27)

The fore and aft sailing rig makes it possible to tack. The foredeck provides shelter for food and clothing; the crew can even take refuge under it if necessary.

The four live wells will keep alive most fish caught by hand-lining. (When the boat is under way, the water is constantly renewed in the wells through holes bored through the bottom of the boat.) Of course, if other methods such as longlining or gillnetting are used, the fish caught will be dead, and the trips will have to be limited to one day, unless ice is available at a reasonable price.

Such a boat will be adequate for many types of fishing, including even trochus and pearl-shell diving, turtle fishing and pole fishing for bonito.

The main use to which she would be put will determine the type of engine needed. A speed of five knots will be sufficient for hand-lining a short distance away, but for bonito fishing the boat should be capable of making at least seven knots. I expect a 12-20 b.h.p. engine would cover all requirements.

Further details will be gladly supplied to anyone interested. Enquiries should be directed to the Secretary-General, South Pacific Commission, Nouméa, New Caledonia.

Literacy In The South-Western Pacific

LITERACY In The South-Western Pacific is the title of the first part of a report by Dr. Karel Neijs, former Literacy Adviser to the South Pacific Commission, that has now been produced in mimeograph form. Copies, in English or French, are available on request.

The report provides a general survey of the present state of literacy in Netherlands New Guinea, Papua and New Guinea, British Solomon Islands and the New Hebrides, against the varying educational, linguistic and sociological backgrounds, and goes on to make suggestions for possible programmes of work in this field.

The second part of the original report is a precise account of an experimental course in adult literacy teaching conducted by Dr. Neijs in collaboration with the Department of Education in Papua and New Guinea, and includes samples of the teaching materials used in the course.

This part will be published shortly in the Commission's Technical Paper series under the title, *An Experimental Course in Adult Literacy*.

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Health Education: How It Strikes An Anthropologist

The article below was a background Paper for the health education training course for Pacific islanders, held under SPC-WHO auspices at Commission headquarters in July and August of last year.

By MAURICE FREEDMAN*

BECAUSE social anthropology is the study of how men live in society, one could easily imagine the titles of a number of books which anthropologists might write if they turned their attention to problems of health education. In this article I propose merely to reflect on some of the topics which the writer of one of these books would need to consider.

I begin with a distinction often ignored or obscured in discussions on the relations between the social sciences and health education. Men and their activities in society can be analysed into two different systems: first, a system of social relations in which persons and groups are linked together by rights and duties variously prescribed; and second, a system of conduct which predisposes men to think and behave in fixed ways according to circumstances. The first system we may conveniently call social; to the second system we may give the name cultural.

When the health worker[1]—as he increasingly does nowadays—turns to the anthropologist for his help, he appears to seek aid primarily in the cultural field. People are resisting medical innovations, for example. What traditional ideas, prohibitions, and practices lie behind their resistance? People will not avail themselves of the food resources in their environment. What customs, taboos, and prejudices bring them to this pass?

Quite rightly the health worker assumes that the anthropologist is supposed to be an expert in such matters, at least as far as the under-developed world is concerned. But if the anthropologist entering the medical field contents himself with giving answers to questions of this order he is in fact doing only half the job for which he is trained. As an analyst of society the anthropologist can do much more than simply offer to the health worker a list of traditional beliefs and practices.

My point can be illustrated in two different ways. Every health worker must, by his very nature, attempt to manipulate social relations. In order to make an impact on a given community he needs to find his way into and about it in such a manner as to influence individuals and groups whose positions are crucial to the changes he proposes. In the second place, the health worker is himself a member of a social system which embraces his public and his colleagues; as a result, the effectiveness of his professional endeavour may depend very directly on how far he appraises himself and his activities in relation to his fellow citizens.

To give some reality to these propositions I shall draw on my experience in South-East Asia. I am far from intending to suggest that the kinds of problems I discuss in the context of certain under-developed countries are their exclusive property. I am assured by my medical acquaintance that these problems appear in one form or another the whole world over, and if I refrain from global generalizations here it is only because I prefer to speak on the basis of what I know best. There is, however, implicit in what I say the assumption that, if my general analysis is correct, it applies to the whole world.

What Are Our Assumptions?

In order to influence people within a community we must understand how it is organized, how power and authority are distributed within it, and how it is made up of a number of parts. There is a tendency among health workers in the area I am discussing to make two false assumptions about local communities.

The first assumption is that the administrative framework of a country necessarily gives the social pattern for the country as a whole, and that, in consequence, all the health worker needs to do in approaching a local community is to follow the lines of communication established by the administrative framework.

The second false assumption is that where, as a result of recent national revolution and political change, there exist official programmes and schemes for general betterment, these programmes and schemes are statements about actual sets of conditions. What seems often to happen is that, in their enthusiasm for bringing about a better world, the people who are charged with instructing and helping the masses imagine that because the government has provided a certain type of administration and projected or legislated certain reforms, the lives of ordinary people already have a new shape.

Administrative units and units of local organization are by no means necessarily coincident. The headman of a village may be, and sometimes is, a man whose position is accepted by his fellow villagers and supported by traditional political ideas and institutions. The health worker who knocks on this man's door may reasonably expect by this means to be able to get one foot inside the community. But it can also happen that the headman in an administrative system lacks a *point d'appui* in local society and operates as a letter-box for government rather than as a representative of his community. The health worker standing on this man's threshold is not likely to see a door opening into the community.

It is clear that the health worker needs to find out precisely how the administrative headman and other leaders of the community, formal and informal, stand in relation to one another and to the community at large. This kind of investigation must be carried out whenever there is any reason to believe that conditions vary from one part of a country to another; and perhaps I do not need to labour the point that in most countries conditions do in fact change considerably from district to district.

Coming To Grips With The Community

I am familiar with two rural areas in one of the countries of South-East Asia which aptly illustrate the variation in political structure to which I have been referring.

In one of them the administrative boundaries do not correspond to any boundaries between communities because this is an area of dispersed settlement without defined localities. There is a hierarchy of headmen and other officials presiding, as it were, over units marked on a map. Registering the population and passing down government orders, the headmen carry out their duties among sections of the people not amounting to organized social groups. They have no place in any traditional system of local leadership and exercise little influence, outside their strictly bureaucratic duties, in local affairs. Moreover, not only is there lacking a village organization in this area, but the fluidity of local society is further ensured by a kinship system,

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[1] I use the term "health worker" in its broadest sense and nowhere in the article refer to "health educators". I assume that health education lies within the province of many kinds of health workers.

of a type which anthropologists call bi-lateral, in which there is no principle of descent to provide for the emergence of groups of kinsmen as corporate groups.

In a situation such as this, where there are few formal aspects of community organization, the health worker could scarcely expect to find it easy to make contact with people. After paying his respects to the headman he would need to look about to find other means of making an entrée. Of course, finding these other means would be a painstaking business for which there is little guidance in the textbooks.

My own experience in this area leads me to suppose that a health worker would need there to take account of two important facts. The first of these is that by patient day-to-day observation one can discover men in the area who, mainly because of their economic position, exercise influence in a system of informal leadership. The second fact is that below the surface of a comparatively formless social organization there lie sets of neighbourly relations which could provide a framework within which someone seeking to influence the people might work. In particular, some of the men form themselves into visiting groups which, after the evening meal, go the rounds of their houses, turning over in conversation various topics of the day.

Although this area is close to the largest city in the country and relies on a money economy, its inhabitants are poor, uneducated, and remote from the national ideology which animates the country's leaders and educators. Health education which assumes that people are prepared to respond quickly to appeals to national sentiment and are imbued with the notion of progress would not be likely to make headway there. The education which is carried out over the radio does not reach them; they have no wireless sets. The education purveyed by the newspapers does not get to them; they rarely look at a newspaper. The health posters they see in the urban area have no meaning for them. When they see propaganda films they do not appear to relate what they see to their own lives.

Because, then, mass media of education and approach through formal leaders are ruled out by circumstances, the health worker in this area would need to fall back upon informal means and personal methods of education. But he could do this only by working outside office hours and making use of political and social skill. Participating in the visiting groups at night would do more than exhortations directed to an ill-defined population through official headmen.

The second rural area forms a strong contrast. It consists of a compact village governed by a blending of traditional and administrative offices. The villages are divided into a number of uni-lineal descent groups, and the heads of these

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PASCALL SWEETS MAKE LIFE SWEETER

kinships units along with the religious authorities in each of the territorial divisions of the village form a body of village opinion which works with and checks the administrative headman.

Great stress is laid in the village on both traditional and modern forms of social organization; the health worker entering this community would be likely to find himself, willy nilly, guided into the meetings and associations which the people have formed for themselves. Furthermore, because the people of this village are well-to-do and for the most part literate and interested in the political and economic problems of their country, they clearly offer to the health worker some of the most promising material he could find anywhere.

But the anthropologist must not stop at the point where he says that different rural communities in the same country are differently organized and call for different treatment by the health worker. He must go on to stress the need for taking an objective and realistic view of country life and for discarding the romantic picture of the rural community as a unified and harmoniously co-operative little society.

Views of this misleading kind are held by some administrators and health workers because their own backgrounds have not familiarized them with the realities of peasant life. It is indeed far safer to assume of any community that it is riven by factions than to imagine at the outset that it is monolithically organized behind a single leader. Rivalries between families, clans, territorial divisions, political associations, and the like are the very stuff of social life: the health worker would be ill-advised to ignore them.

The health worker unwise in the ways of the world might easily find himself cut off from one part of a community because of his attachment to another, or used as a pawn in a continuous game played between different sections of the community. The pitfalls may be sometimes unavoidable, but the wary health worker is not likely to find frustration as easily as his less sophisticated colleague.

In a word, the health worker needs to have before him a clear picture of the structure of the community in which he is to carry out his duties. But this, as I have suggested earlier, is only one part of the sociology of health education. The other part is the study of health workers and medical institutions in relation to the public they set out to serve. This is an important kind of study for the very reason why it is so seldom undertaken; we assume that we know how medical institutions work; we take the rules of medical behaviour as given and find a problem only in the failure of the public to accept them.

If the health worker is able to stand back and see himself as part of a social system in which his own preconceptions

and shortcomings in social knowledge affect his work, then he may expect to come closer to the ideals of practice set up for him by his profession.

The Health Worker Is Part Of The Society He Serves

The false romanticism about the nature of rural life to which I referred earlier is one aspect of what we might call the "social ignorance" imposed on health workers by their position in society. Health workers are never drawn at random from their society; they are recruited from among special social classes and groups; their general and educational backgrounds are rarely such as to give them a direct knowledge of and insight into the living conditions of their humbler fellow citizens. But since they are often unaware of the gap between their knowledge and reality they work on assumptions about their public which they do not think of putting to the test. Those of us who have had the opportunity of living in both developed and under-developed countries know that the gap in understanding between the middle-class doctor and his working-class patient in industrial society is matched by the distance between, say, the Asian doctor and his peasant clientele.

There are several tests of the health worker's insight into his own position. One of them is his ability to examine how far he is meeting the expectations of his clients. The sensitive doctor, for example, in a country where Western medicine is striding forward into the peasant world, may come to realize that the methods of diagnosis and treatment in which he has been trained fail to satisfy patients whose traditional medicine has led them to expect something different from their medical adviser. If peasants are used to an indigenous system in which the practitioner takes a prolonged and intense interest in their troubles, then they are likely to be disappointed and dismayed by the apparently casual methods of the Western-trained doctor whom they find in the local clinic or hospital.

A second test is the health worker's readiness to question the generalizations made in medical circles about the public at large. The medical profession appears to develop bodies of folklore about its patients, and health workers in general often see their public through the screen which this folklore erects. Behaviour which is undesirable by medical standards, for example, is sometimes attributed to irrational motives when perhaps its economic cause has passed unnoticed. People who produce eggs, meat, and milk and yet fail to consume these things themselves or give them to their children are sometimes accused of bizarre behaviour. The health worker who studied the economics of production of these foodstuffs might well conclude that peasants simply cannot afford to eat

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Similarly, the health worker seeking to transcend the limitations imposed on him by his status might give his attention to testing the truth of such generalizations about public practice as—"Mothers in this country prolong breastfeeding in order to avoid pregnancy". Statements of this order sometimes turn out to be doctors' folklore.

A third test, and one which is probably the most difficult of all for the health worker to apply to himself, consists of examining his own political and cultural ideals in relation to those of his clients. We are not at this point so far from medical matters as may appear at first sight, for in countries undergoing political and social change, particularly of a revolutionary character, doctors and health workers form an important part of the elite which stands in the van of progress. As a result, their aspirations may be projected so far ahead of those of the public at large that there is lack of sympathy on the part of the elite for the conservatism of the masses. It is of course true that peasants are often backward and ignorant; but the health worker who knows how the difference between his own outlook and that of his clients has come about is in a better position to help them than his less sensitive colleagues.

I have tried to show that the anthropologist's experience has directed his attention to two main types of sociological question in the field of health education. First, the health worker trying to influence a particular community must achieve an understanding of its structure. Second, the health worker must come to appreciate the extent to which his own beliefs and activities affect his relations with his public.

There remains one further anthropological point to be made. Health education is an attempt to raise levels and standards of health; but the health of men in society is partly an aspect of their adjustment to one another and to the economic and social institutions by which they live. It follows that, just as the anthropologist uses the working assumption that groups and institutions in a given society are in a state of mutual inter-dependence, so the health worker must also learn to adopt a rounded approach to his problems.

We may consider a very simple example of the extent to which the health worker needs to consider a wide range of social and economic facts in relation to a particular problem.

Peasants are found to be short of certain nutrients and, in consequence, are to be induced to cultivate and eat a new food. How would growing a new crop affect the existing agricultural system technically and ritually? What land, labour, and other crops would the people need to sacrifice in order to grow the new crop? What, in effect, would be the real cost of growing it? How far is the new food adaptable to existing methods of preparing, cooking, and serving food? Are there any magical or religious reasons why people may find difficulty in accepting a particular new food? If food is used in exchanges of gifts between individuals and groups, will the introduction of a new food hinder these exchanges? How will a new food affect the diet, and possibly in consequence the status, of different categories in the community: male and female, old and young, noble and commoner?

There is little point in extending the list of questions; they are obvious as soon as one begins to consider the ramifications of social facts. Yet while it is comparatively simple to establish the principle that the activities and groupings of men in society are inter-connected, the anthropologist looking at work done in the field of health education must sometimes wonder whether the training of health workers and the administrative system within which they function allow them to make use of the principle.

I have not attempted to discuss in this article the enlistment of anthropologists by medical services. I have suggested only that the sociological reflexions to which the anthropologist's study of health education gives rise may be a guide to health workers themselves in their own efforts to solve their problems.

The anthropologist has no private magic for pulling rabbits out of hats; the problems involved in changing beliefs and practices in the field of health are for the health workers to attack; but the experience of anthropologists is available if health workers want it.

Gigantochloa verticillata (Willd.) Munro. Left: Fifteen-foot plant two years old from rooted branch cutting. Federal Experiment Station, Mayaguez, Puerto Rico. March 1949. Right: Leafless plant that died from unknown cause; an old clump with culms up to 65 feet tall and 5 inches in diameter. Tela Railroad Company, Agricultural Experiment Station, Lancetilla, Honduras. March 1948.

Bamboos For The Pacific Islands

(Continued from page 22)

age of the soil, the amount and seasonal pattern of rainfall, the intensity and angle of incidence of the sunshine, air movements, and many other, more obscure but still significant, factors.

The only way to find out what response any bamboo will show on a given site is *by actual trial*. Until such local trials have been made, it will not be possible to provide more than very general indications of the conditions under which these bamboos may give a favourable response.

In general, bamboos may be expected to make their most vigorous growth under conditions of high soil fertility, with abundant rainfall well distributed throughout the year. The clump bamboos are generally favoured by year-round high temperatures.

Prolonged drought is apt to be prejudicial, especially if the water table is more than a metre or so below the surface. On the other hand, good drainage is essential to most bamboos. Soils with a hard-pan layer above the water table are apt to prove unsuitable for the cultivation of bamboo. Exposure to high winds is generally harmful, especially if combined with high temperatures and low relative humidity. Heavy clay soils generally give better results than light or sandy soils. Alkaline or saline conditions are apt to be highly unfavourable.

Attention is directed to a practice common among bamboo growers in China in cases where quality (hardness and strength) of wood is more important than large size of individual culms or total annual yield per unit area. In such cases relatively poor soils and dry sites are used in preference to fertile ones. Culms of *Bambusa textilis* grown under this regime give years of service as bean and cucumber stakes in the Canton delta.

In the lack of previous experience or

contemporary example it is advisable to begin the culture of any bamboo on a small scale, with a view to ascertaining its response on each untried area or in each new ecological setting.

Optimum planting distances for the species and the combination of ecological conditions peculiar to each site should be determined before large-scale plantings are undertaken. As the plantings are expanded, harvesting and seasoning schedules and other details of management and utilization may be studied and marketing outlets developed.

Presence Of Cyanogens In The Young Shoots Of Tropical Bamboos

The occurrence of cyanogens in the young growing shoots of certain tropical pasture grasses is a matter of common knowledge among alert livestock men. It is probably not so generally realized that the young shoots of a number of the tropical bamboos are also known to contain cyanogens. Care should therefore be exercised to prevent all livestock from having access to bamboo plants during the period when the growing points of young shoots stand within the reach of the animals.

Since there is no record of the occurrence of cyanogens in bamboo leaves, there is no occasion for concern on this score, when animals are given access to bamboo plants as a source of browse during seasons when there are no young shoots.

Since boiling quickly drives off the cyanogens from sliced or diced bamboo shoots, there is no risk involved in using cooked bamboo shoots in the human diet. The use of uncooked, pickled bamboo shoots, however, is not to be recommended.

(The second instalment of this article will appear in the July issue.—Editor.)

1958 Pearl-Shell Exports From French Polynesia

DURING 1958, production of mother-of-pearl shell in French Polynesia is expected by local experts to reach 600 tons, three-quarters of which it is estimated will come from the famous atoll of Marutea in the Tuamotu Islands. Export prices are expected to vary from 100 to 140 Pacific francs per kilogram (2.2 pounds), which represents a fall on last year's prices.

READING LIST No. 22

THIS reading list represents an attempt to note every item to appear in the field of Social Development in the last six months. The entries are drawn from over 70 periodicals, which are regularly examined, and from bibliographies, publishers' notices and similar material. Publications of the South Pacific Commission have not been listed. Items marked with an asterisk have not been seen in the Social Development Section.

The Social Development Section, Box 5254, G.P.O., Sydney, will be pleased to obtain copies of items listed for metropolitan or territorial Governments.

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PACIFIC READING

Material in this section is contributed by the South Pacific Commission Literature Bureau. Any enquiries relating thereto should be directed to Box 5254, G.P.O., Sydney, Australia.

Film Appraisal Service. Arrangements have now been completed for the Commission's Film Appraisal Service to be operated in co-operation with the Commonwealth National Library of Australia. A new catalogue setting out revised conditions of loan of films and explaining other changes will be issued shortly. Requests for the loan of films should continue to be addressed to the Commission in Sydney, but for a week or two there may be some slight delay in meeting requests while the transfer of films to the National Library is being effected. As a result of these changes an increased selection of films will become available for viewing.

New Literature Bureau Publications. During recent months several new publications have been produced through the Literature Bureau in co-operation with publishers and on behalf of various territories. The covers of these books are depicted in the accompanying illustration.

The books *How the Crocodile Got His Teeth* and *A Recipe Book for Pacific Islanders*, referred to in Notes and News for last January have been produced in association with Macmillans. The first mentioned book is a collection of nine amusing animal stories specially written for the Pacific area, whilst the latter is a comprehensive selection of recipes and cooking information suitable for islanders.

Dongeng Tanah Kita is a Malay edition of three folk stories and has been produced especially for the Government of Netherlands New Guinea. Attractively illustrated with black and white and 2-colour illustrations, this supplementary reader has been published in the *Coral Series*.

The other small booklets—*Fish Preservation Simplified* (English and French editions) *Don't Let the Big Fish Go* (English and Fijian editions) and *Solomon Island Stories* (re-print)—are examples of small edition book production using the multilith offset process. These books are well illustrated with line drawings and in each case the simple English text has been set up on a modern electric typewriter. Single specimen copies of these booklets together with details of production costs are available from the Literature Bureau.

Literature Bureau Staff. Mr. W. N. A. Allison, lately Director of Education in the Cook Islands has now taken up his duties on the Literature Bureau staff in succession to Mr. D. Pearce who left to become Director of the new Literature Agency in the British Borneo Territories.

Supplementary Readers for Oxford English Courses. Users of the Oxford English Courses in the islands will welcome the appearance of the first of a special new series of supplementary readers to accompany them entitled *Oxford Story Readers for the Pacific*.

The first of these is *Why Cocks Crow*, and consists of six stories from the Pacific, each accompanied by a little group of class exercises which should prove very helpful to the island teacher. The fact that the characters, objects and situations in these stories are such as would be found in the majority of Pacific islands, and the vocabulary and sentence structures are carefully related to books in the existing courses, is a great step forward and means that it is now becoming possible for Pacific island schools to meet one of their most urgent reading needs.

This member of the series is related to Book 4 of the Oxford English Course for Papua and New Guinea. Another member in the series, *Tui Liku and the Giants*, also related to Book 4, will appear shortly. The setting is Melanesian rather than Polynesian, but not obtrusively so, and these books are worth examining throughout the South Pacific. Typographical arrangements and illustrations are attractive. The price is A.3s.

New Guinea. No. 7 in Longmans *Australian Geographies* is devoted to New Guinea. The text covers physical and climatic features of the area, the people who live there, and the economy of their region; a final chapter describes recent developments and discusses the possible future.

This little book of 40 pages is attractively produced and illustrated by numerous good photographs and two colour maps and diagrams. The author is Dr. Andrews of Sydney University.

Although the book is produced primarily from the point of view of Australian schools, it should provide a very useful source book for island teachers having a fair command of English. It should be useful also to teachers in islands other than New Guinea who are looking for accurate information about the latter country, within small compass. The price is A.5s.3d.

New Reader for Netherlands New Guinea. A new title has been added to the *Coral Series* of supplementary readers. This is a Malay edition of three folk stories entitled *Dongeng Tanah Kita*, produced especially for use in Nether-

Depicted above are the covers of several new books produced during recent months through the Literature Bureau in co-operation with publishers and on behalf of various South Pacific territories.

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Their vocabulary is based on the words learnt in the *First Book, Second Book,* and *Third Book* of *Oxford English Course for Papua and New Guinea.* They would therefore be suitable as readers to accompany either the *Fourth Book* or the later stages of the *Third Book,* but could, of course, also be used with any English course book of a similar grading.

Other books of the same difficulty are:

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THE ANIMALS' BAND	1/11
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SEVEN AFRICAN TALES	1/3
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THE GOAT AND THE HYENA	1/3
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P'ING SHU THE STORY TELLER	1/3
THE KING WHO LOVED RIDDLES	1/3
THE PRINCE WITH THE GOLDEN HAIR	1/2

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OXFORD UNIVERSITY PRESS

346 LITTLE COLLINS STREET MELBOURNE

lands New Guinea. Attractively printed on good quality paper with a 2-colour cover page, this book is illustrated with excellent black and white and 2-colour illustrations. The Bureau has obtained a translation of these stories and it is hoped that an English version may be produced in the near future.

Geography of Tonga. Attention is drawn to this new publication from the Government Printer, Nuku'alofa, Tonga. It is by T. F. Kennedy, M.A., F.R.G.S., Principal of Tonga College.

The book covers not only the physical characteristics of the island geography but also its agriculture, people, villages and towns, communications, and trade. Written for use in secondary schools in Tonga and teachers in primary schools, this book makes a valuable addition to Pacific materials at this level. Schools in metropolitan countries which wish to study a 'type' Pacific island in detail would find this an authentic and convenient piece of source material. 88 pp., 15 maps and diagrams, and 20 photographs.

VISUAL AIDS

Films in the Commission library are marked with an asterisk before the title, and are available for viewing by any metropolitan or territorial government on application to the Executive Officer for Social Development, Box 5254, G.P.O., Sydney, N.S.W., Australia. Age classifications, where given, are intended as a guide rather than a recommendation.

Filmstrips

BATTLE AGAINST POVERTY. Produced by Central Office of Information. H.M.S.O. London. Black and White. 29 frames. Teaching notes. Publishers' price stg.5s.

Medium: Improvement of Living Conditions.
Technical Standard: Photographs.
Comment: Average.
Subject: The centries-old heritage of poverty in many of Britain's Overseas Colonies is now giving place to an era of prosperity and content. The strip first outlines the main causes of poverty —primitive farming methods, soil erosion, disease, locusts, hurricanes and ignorance—and then shows what is now being done to combat and eradicate them. With the assistance of funds made available under the Colonial Development Acts, considerable progress has been made to improve economic and social conditions in most territories by agricultural development, soil conservation and irrigation, reafforestation, medical and welfare services, an establishment of secondary industries, and the introduction of co-operative systems of marketing. The photographs are generally good and the teaching notes are adequate.

CUT OUTS UP TO DATE. Produced by Unicorn Head Ltd., London. (National Film Board of Canada). Colour. 45 frames. Teaching notes. Published price stg.25s.

Subject: Paper cutting.
Medium: Photographs.
Technical Standard: Excellent.
Comment: Scissors, coloured paper and a little imagination are the basic ingredients of this well presented strip. Forty-five interesting frames in colour show how coloured papers can be cut into a few basic shapes and then re-arranged and pasted together to form delightful pictures. Examples shown include animals, fish, fruit and people.

THE SOLAR SYSTEM. (Astronomy Series). Produced by Common Ground Ltd., London. Black and white. 41 frames. Teaching notes. Published price stg.15s.

Subject: Astronomy.
Medium: Photographs and diagrams.
Technical Standard: Above average.
Comment: As stated in the introduction to the notes the aim of this strip is "to expand in some detail the basic facts outlined by such diagrams of the Solar System as most atlases contain." This is done in an admirable manner and the strip gives a very clear insight into a difficult subject. The material is presented in the form of a journey through the Solar System, beginning at the sun and

(*Continued on page 62*)

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